



About This Guide

This section discusses the audience, organization, and conventions of this installation and configuration guide.

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM, a member of the Cisco Connection Family, is updated monthly. Therefore, it might be more current than printed documentation. To order additional copies of the Documentation CD-ROM, contact your local sales representative or call customer service. The CD-ROM package is available as a single package or as an annual subscription. You can also access Cisco documentation on the World Wide Web at <http://www.cisco.com>, <http://www-china.cisco.com>, or <http://www-europe.cisco.com>.

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Audience

This publication is designed for the person installing Cisco 1600 series routers who should be familiar with electronic circuitry and wiring practices and have experience as an electronic or electromechanical technician.

Use this guide together with the quick-reference installation guide and with the *Cisco 1600 Series Software Configuration Guide* that came with your router.

Installation Guide Overview

This guide contains the following chapters and appendices:

- **About This Guide**—Provides an overview of and describes conventions of this document.
- **Overview of the Router**—Provides an overview of the router models, including connector descriptions, types of networks supported by each model, and product features.
- **Installing the Router**—Describes how to make LAN and WAN network connections.
- **Optional Installations**—Describes how to perform some installations that not all users may require, including wall-mounting the router, installing a WAN interface card, installing a Flash PC card, and connecting an ISDN telephone to a Cisco 1604.
- **Troubleshooting**—Describes how to isolate problems you might encounter with the router or to rule out the router as the source of the problem.
- **Configuring the ISDN Line**—Describes how to order and configure Integrated Service Digital Network (ISDN) Basic Rate Interface (BRI) for Cisco 1600 series routers.
- **Hardware Specifications and Cable Pinouts**—Contains router hardware specifications and pinouts for cables used with Cisco 1600 series routers.

Installation Guide Conventions

This guide uses the following conventions:

- **Boldface font** is used for commands and keywords.
- *Italic* is used for command input that is supplied by you.
- Screen font is used for examples of information that is displayed on the screen.
- **Boldface screen font** is used for examples of information that you enter.
- Square brackets contain keywords or arguments that are optional or default responses to system prompts:

[x]

- Braces contain a choice of keywords (represented by x below) that are separated by vertical bars:

{ x | x | x }

- Angled brackets contain characters that are not echoed on the screen, such as passwords:

<password>

- The key labeled Control is represented by [^] or **Ctrl-D**. For example, when you read [^]D or *Ctrl-D*, you should hold down the Control key while you press the D key.

Note Means reader take note. Notes contain helpful suggestions or references to material not contained in this guide.



Caution Means reader be careful. In this situation, you might do something that could result in equipment damage or loss of data.



Warning Means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and familiar with standard practices for preventing accidents.

To see translations of the warnings that appear in this document, refer to the regulatory compliance and safety information document that came with your router.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

Varoitus Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista.

Attention Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents.

Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewußt.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed essere al corrente delle pratiche standard per la prevenzione di incidenti.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som kan føre til personskade. Før du utfører arbeid på utstyr, må du være oppmerksom på de faremomentene som elektriske kretser innebærer, samt gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer equipamento, familiarize-se com os perigos relacionados com circuitos eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis acidentes.

¡Advertencia! Este símbolo de aviso significa peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considerar los riesgos que entraña la corriente eléctrica y familiarizarse con los procedimientos estándar de prevención de accidentes.

Varning! Denna varningssymbol signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanligt förfarande för att förebygga skador.

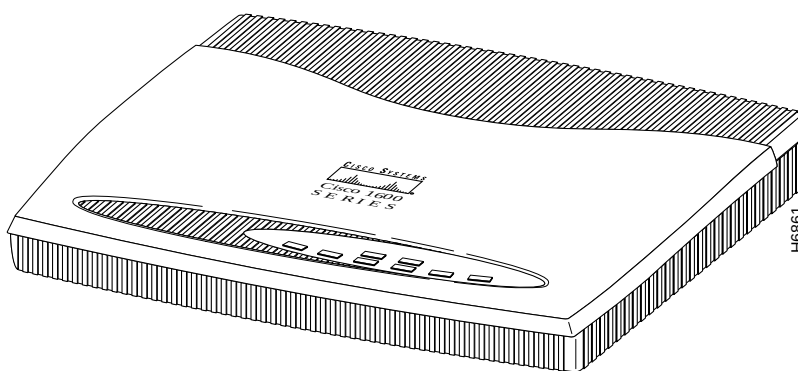
Overview of the Router

Cisco 1600 series routers are a family of small desktop routers that link small-to-medium remote Ethernet LANs to regional and central offices over multiple WAN connections.

This chapter contains the following sections:

- Router Features
- WAN Interface Cards
- Rear-Panel Connectors
- Router Memory
- Unpacking the Router
- Equipment That You Must Provide

Figure 1-1 Cisco 1600 Series Router Front (All Models)



Router Features

Note The Cisco 1600 series routers are either run-from-flash (RFF) or run-from-RAM (RFR) models. Router model names with an *R* are RFR routers; all other models are RFF. In this document, model names without an *R* refer to both RFF and RFR models, except where noted. The “Router Memory” section later in this chapter describes the differences between RFF and RFR models.

Listed below are some features of the Cisco 1600 series routers:

- One or two Ethernet LAN connections, using either the 10BaseT or AUI LAN ports. (Refer to Table 1-1 for more information about the LAN connections supported by each model.)
- One fixed WAN port (except for the Cisco 1605). (Refer to Table 1-1 for more information about the WAN connections supported by each model.)
- One slot for a WAN interface card, for flexibility in choosing WAN connections that the router supports. (Refer to the section “WAN Interface Cards” later in this chapter for more information about WAN interface cards.)
- Flash memory PC card (PCMCIA-compatible), which can be preconfigured by a network administrator and installed in the router at a remote site.
- Console port, which supports router management using a terminal or a PC with terminal emulation software.
- Router management over the network using Simple Network Management Protocol (SNMP).
- AutoInstall for downloading configuration files automatically over a WAN connection.
- Security slot for Kensington-compatible lockdown cable.

Table 1-1 describes in detail the types of LAN and WAN connections that are supported by each of the five router models.

Table 1-1 Network Connections Supported By Cisco 1600 Series Routers

Model	LAN Interface(s)	Fixed WAN Interface
Cisco 1601	- One 10BaseT - One AUI¹	Serial: - Supports synchronous modes, such as leased lines, Frame Relay, 56-kbps services, SMDS, and X.25, up to 2.048 Mbps (EIA/TIA-232, V.35, X.21, EIA/TIA-499, EIA-530). - Supports asynchronous connections up to 115.2 kbps.
Cisco 1602	- One 10BaseT - One AUI	Serial—Supports synchronous mode, including 56-kbps and dataphone digital service (DDS) connections, with an integrated 56-kbps DSU/CSU ² .
Cisco 1603	- One 10BaseT - One AUI	ISDN BRI S/T—Supports one ISDN BRI connection. (An ISDN BRI connection consists of two 64-kbps B channels and one 16-kbps D channel.)
Cisco 1604	- One 10BaseT - One AUI	One ISDN BRI U—Supports routing over an ISDN BRI connection. One ISDN BRI S/T (with integrated NT1 ³)—Supports one additional ISDN device (such as an ISDN telephone) on the same ISDN line as the router.
Cisco 1605	- Two 10BaseT - One AUI The Cisco 1605 supports two LAN connections.	The Cisco 1605 supports one WAN interface on a WAN interface card that can be installed in the router. A variety of WAN types are supported, depending on the type of card installed. For more information on individual cards, refer to the <i>Cisco WAN Interface Cards Hardware Installation Guide</i> that comes with each card.

¹ AUI = attachment unit interface.

² DSU/CSU = data service unit/channel service unit.

³ NT1 = Network Termination 1.

WAN Interface Cards

On the Cisco 1601 through Cisco 1604, you can use the WAN interface card connection as a secondary WAN connection, which can be used if the router on-board WAN connection fails. On the Cisco 1605, you can choose the type of WAN connection that you want for your network.

For more information about the cards, including function, installation, and configuration, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* document that comes with the card. You received this document if you ordered a WAN interface card.

Rear-Panel Connectors

Figure 1-2 through Figure 1-6 illustrate the connectors for each of the five router models.

Figure 1-2 Cisco 1601 Rear Panel

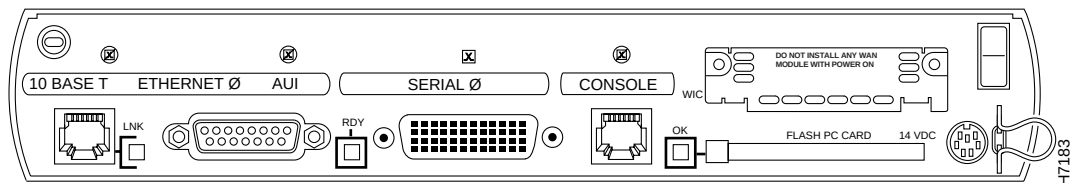


Figure 1-3 Cisco 1602 Rear Panel

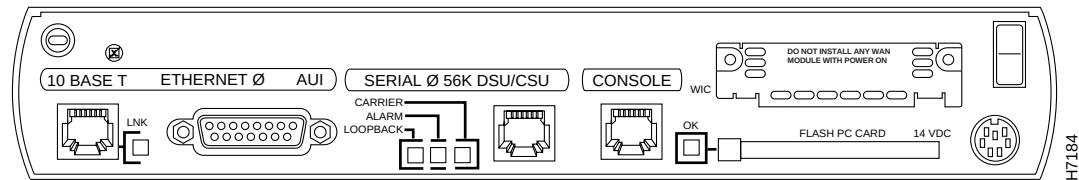


Figure 1-4 Cisco 1603 Rear Panel

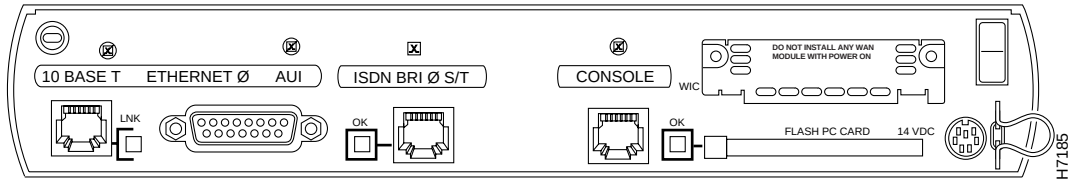


Figure 1-5 Cisco 1604 Rear Panel

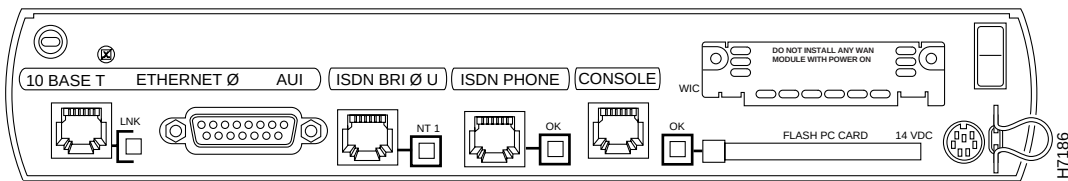
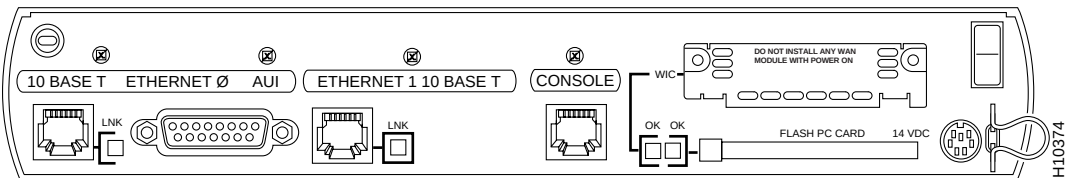


Figure 1-6 Cisco 1605 Rear Panel



Rear-Panel Connectors

Table 1-2 describes the connectors on the rear panel of the router.

Table 1-2 Function—Rear Panel Connectors and Slots

Label	Router Model	Function
ETHERNET Ø • 10BASE T • AUI	All	• Connects the router to a 10BaseT Ethernet LAN through an Ethernet hub or switch. • Connects the router to an Ethernet LAN through a transceiver.
CONSOLE	All	Connects the router to a terminal or to a PC running terminal emulation software for configuration.
WIC	All	Slot for a WAN interface card, which provides an additional WAN connection for models Cisco 1601 through Cisco 1604 and the only WAN connection for the Cisco 1602.
FLASH PC CARD	All	Slot for the Flash PC card. The router is shipped to the customer with the card already installed.
SERIAL Ø	Cisco 1601	Connects the router to serial WAN services, such as leased lines, Frame Relay, 56-kbps services, SMDS, and X.25.
SERIAL Ø 56K DSU/CSU	Cisco 1602	Connects the router to 56-kbps and dataphone digital service (DDS) through an integrated 56-kbps DSU/CSU.
ISDN BRI Ø S/T	Cisco 1603	Connects the router to ISDN services through an external NT1 device (purchased separately from the router).
ISDN BRI Ø U	Cisco 1604	Connects the router to ISDN services through an integrated NT1.
ISDN PHONE	Cisco 1604	Connects an ISDN device, such as an ISDN telephone, through the router to the same ISDN line that the router uses.
ETHERNET 1 10BASE T	Cisco 1605	Connects the router to a 10BaseT Ethernet LAN through an Ethernet hub or switch. The Cisco 1605 supports up to two Ethernet LAN connections.

Router Memory

The Cisco 1600 series routers are either of run-from-flash (RFF) or run-from-RAM (RFR) models. Router model names with an *R* are RFR routers; all other models are RFF. In this document, model names without an *R* refer to both RFF and RFR models, except where noted. This section describes the two memory architectures used in the Cisco 1600 series routers.

Run-From-Flash Architecture

With RFF, the microprocessor uses the uncompressed Cisco IOS software image that is stored in Flash memory. The software image runs directly from Flash memory. RAM stores working data such as Cisco IOS data structures, network routing tables, and packets to be transmitted to and received from network interfaces.

The running software image cannot be used to download new software to Flash memory because it would attempt to overwrite itself. (However, when you are using Dual Flash Bank memory, you can download the new software image into a different Flash memory partition.)

To download a new software image without using Dual Flash Bank memory, a boot-helper image (called *XBOOT*) has been added to the ROM on the RFF models. The boot-helper image is a small subset of Cisco IOS software that supports only a subset of the interfaces and the WAN protocols. RFF ROM supports the following WAN interfaces. (These are all onboard interfaces, not WAN-interface-card interfaces.)

- Serial (synchronous and asynchronous) (Cisco 1601)
- DSU/CSU (Cisco 1602)
- ISDN S/T (Cisco 1603)
- ISDN U (Cisco 1604 and Cisco 1604 R)

When upgrading the Cisco IOS software in Flash memory, you must boot the router from the ROM image. The Flash memory can be overwritten because the Cisco IOS software that is stored in Flash memory is not being used to run the router.

Run-From-RAM Architecture

With RFR, the Cisco IOS image is stored in Flash memory (usually in compressed form), but is loaded into RAM before being used to operate the router. The running software image then resides in RAM, so a new software image can be downloaded and copied over the software image stored in Flash memory.

In RFR routers, only a minimal boot-helper image is stored in the ROM for disaster recovery. Initial loading of a software image into Flash memory is done over the console port or the local Ethernet.

Because the Cisco IOS image is stored in compressed form in Flash memory and then decompressed when loaded into RAM, the standard configuration for the RFR models contains less Flash memory but more DRAM than the RFF models.

Table 1-3 is a summary comparison of these two memory architectures.

Table 1-3 Memory Architecture Comparison

Feature	Run-From-Flash Routers	Run-From-RAM Routers
Cisco IOS software online download	Yes, when using Dual Flash Bank memory	Yes
Flash memory use	• Stores uncompressed Cisco IOS software image. • The Flash PC card cannot be removed when the router is operating.	• Stores compressed Cisco IOS software image. • The Flash PC card can be removed after the router has finished booting up and has passed the power-on self-test.
RAM use	• Packet memory • Routing tables • Dynamic memory used by Cisco IOS software	• Packet memory • Routing tables • Dynamic memory used by Cisco IOS software • Running uncompressed Cisco IOS software image
DRAM capacity	• Standard: 2 MB onboard • Maximum: 18 MB (with 16-MB SIMM)	• Standard: 8 MB onboard • Maximum: 24 MB (with 16-MB SIMM)

Table 1-3 Memory Architecture Comparison (Continued)

Feature	Run-From-Flash Routers	Run-From-RAM Routers
Flash PC card capacity	• Standard: 4 MB • Maximum: 12 MB	• Standard: 2 MB • Maximum: 12 MB
Disaster recovery (Router fails and the image store in Flash memory is corrupted).	• Cisco IOS software image can be downloaded over any interface and with any WAN protocol supported by the ROM boot helper. • Cisco IOS software image can be downloaded over the console port by using the xmodem or ymodem commands. • Flash PC card can upgraded by booting from a Cisco IOS software image stored in another Flash memory bank (if using Dual Flash Bank memory).	• Cisco IOS software image can be downloaded with the ROM boot helper over the Ethernet 0 interface. • Cisco IOS software image can be downloaded over the console port by using the xmodem or ymodem commands. • Flash PC card can upgraded by booting from a Cisco IOS software image stored in another Flash memory bank (if using Dual Flash Bank memory).

Identifying the Memory Architecture from Cisco IOS

Use the Cisco IOS **show version** command to display some memory architecture information for your router (show in boldface in the example output):

- Amount of onboard DRAM (a type of RAM)
- Whether the Cisco IOS software is running from RAM or Flash memory
- Amount of Flash memory

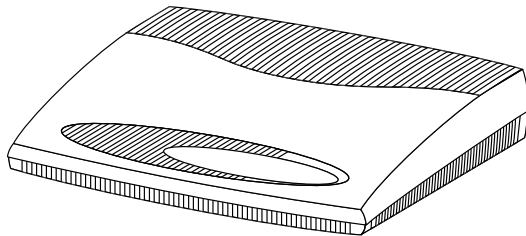
```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 1600 Software (C1600-BNSY-M), EARLY DEPLOYMENT RELEASE SOFTWARE
11.2(9)P
Copyright (c) 1986-1997 by cisco Systems, Inc.
Compiled Mon 11-Aug-97 14:10 by cisco
Image text-base: 0x02005000, data-base: 0x02477BD0
ROM: System Bootstrap, Version 11.1(12)AA,DEPLOYMENT RELEASE SOFTWARE
(f)
ROM: 1600 Software (C1600-RB00T-R), Version 11.1(12)AA, EARLY DEPLOYMENT
RELEASE
Router uptime is 12 minutes
System restarted by power-on
System image file is "flash:c1600-bnsy-mz", booted via flash
cisco 1605 (68360) processor (revision C) with 7680K/512K bytes of
memory.
Processor board ID 06027889, with hardware revision 00000000
Bridging software.
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
2 Ethernet/IEEE 802.3 interface(s)
System/IO memory with parity disabled
8192K bytes of DRAM onboard
System running from RAM
8K bytes of non-volatile configuration memory.
4096K bytes of processor board PCMCIA flash (Read/Write)
Configuration register is 0x2102
```

Unpacking the Router

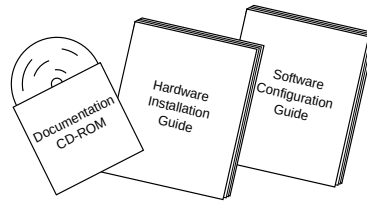
Figure 1-7 shows the other items that come with your router. All of these are in the accessory kit that is inside the box that your router came in.

Unpacking the Router

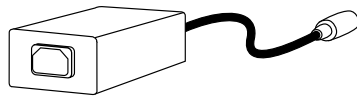
Figure 1-7 Router Box Contents



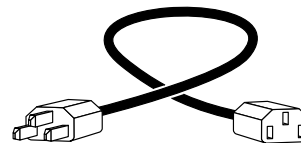
Cisco 1600 router



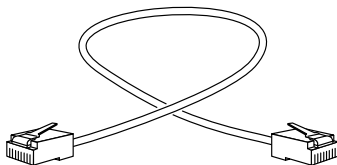
Product documentation



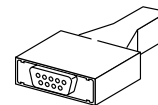
Power supply



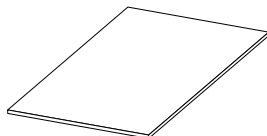
Power cord (black)



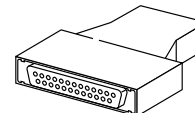
Console cable
(light blue, RJ-45-to-RJ-45)



DB-9-to-RJ-45 console adapter
(light gray)



Flash PC card
(Already installed in router)



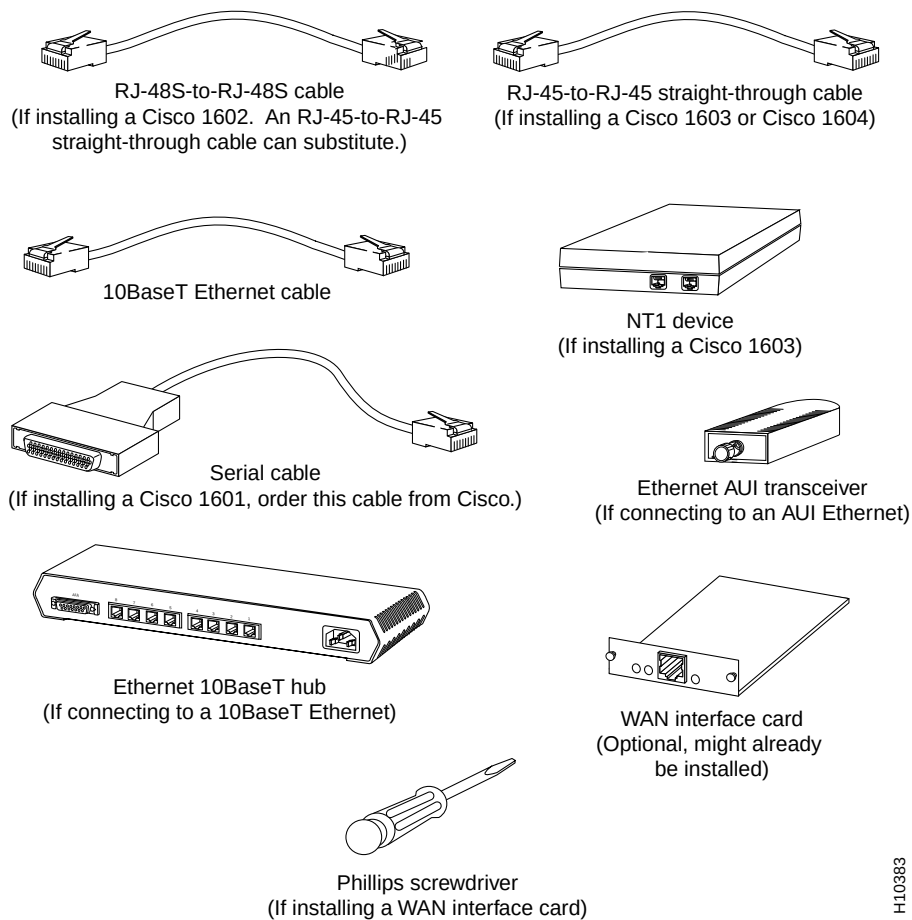
DB-25-to-RJ-45 console adapter
(light gray)

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Equipment That You Must Provide

Figure 1-8 shows items that you will have to provide to install your router. You will require only some of these items, depending on what Cisco 1600 model you are installing.

Figure 1-8 **Items That You Provide**



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Equipment That You Must Provide

Installing the Router

This chapter contains hardware installation procedures for Cisco 1600 series routers and includes the following sections:

- Before Installing
- Connecting Power and Turning On the Router
- Connecting the Router to the LAN
- Connecting the Router to the WAN
- Connecting the Console Port

Note You might want to perform some optional installation steps that are not explained in this chapter, including wall-mounting the router, installing the Flash PC card, connecting an ISDN telephone, or installing a WAN interface card. These procedures are explained in the “Optional Installations” chapter later in this document.

Before Installing

Cisco 1600 series routers are shipped to you ready for desktop mounting. Before making the power and network connections, simply set the router on a desktop, shelf, or other flat surface. Be sure to read the safety information in the *Regulatory Compliance and Safety Information for Cisco 1600 and Cisco 1700 Routers* that came with your router.



Warning Read the installation instructions before you connect the system to its power source.

Connecting Power and Turning On the Router



Caution Do not place anything on top of the router that weighs more than 10 pounds (4.5 kg). Excessive weight on top of the router could damage the chassis.



Warning Do not work on the system or connect or disconnect cables during periods of lightning activity.

Connecting Power and Turning On the Router

If you turn on the router before making network connections, you can verify your installation by checking the appropriate LEDs during the installation process.



Warning The power supply is designed to work with TN power systems.



Warning This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors).



Warning This equipment is intended to be grounded. Ensure that the host is connected to earth ground during normal use.

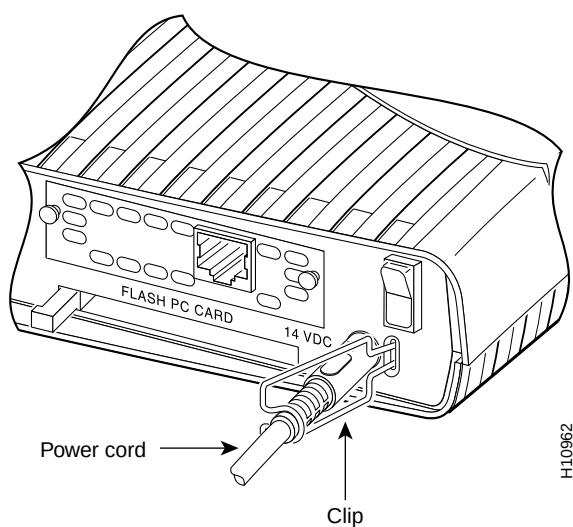
Follow these steps to connect the router to power and turn it on:

- Step 1** Connect the DC power cable (included with the router) from the power supply to the DC power input on the rear panel of the router.
- Step 2** Connect the male end of the power cable to the power outlet.
- Step 3** Connect the female end of the cable to the male receptacle on the power supply.
- Step 4** On the rear panel of the router, turn ON the power by setting the switch labeled | / O to the | position.
- Step 5** Slip the wire clip over the power cord to ensure that the power cord remains attached to the router, as shown in Figure 2-1.

Step 6 Check the following LEDs:

- The SYSTEM PWR LED (front panel)—On when power is being supplied to router.
- The SYSTEM OK LED (front panel)—On when router software is operational. (This LED first blinks and then remains on continuously.)
- The OK LED (rear panel, next to Flash PC card slot)—On when the Flash memory card is correctly installed.

Figure 2-1 Power Cord Clip Attachment



Connecting the Router to the LAN

The router can be connected to two 10BaseT or AUI Ethernet LANs.



Warning Do not work on the system or connect or disconnect cables during periods of lightning activity.



Warning The ports labeled 10BASET, CONSOLE, and FLASH PC CARD are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits.

Connecting to an AUI Ethernet

You must supply an Ethernet transceiver for this connection. Follow these steps to connect the router to an AUI Ethernet LAN:

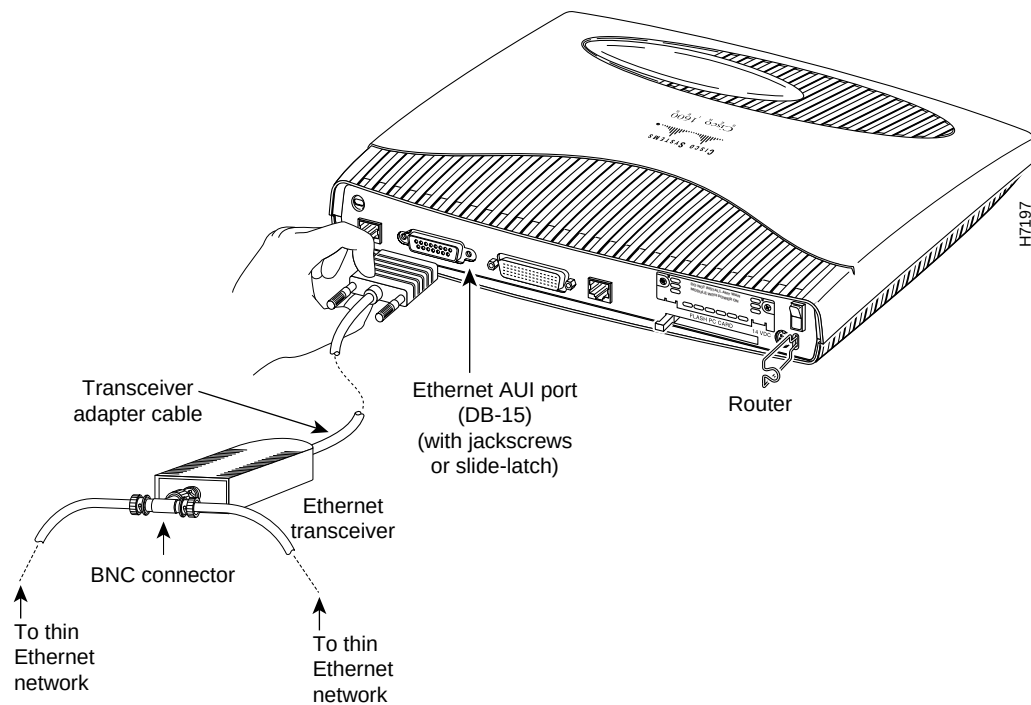
Note Some transceivers connect directly to the router AUI port. If you have this type of transceiver, you do not need the AUI adapter cable. You can connect the transceiver to the AUI port on the router and then go to Step 3.

- Step 1** Connect the one end of the AUI adapter cable to the transceiver.
- Step 2** Connect the other end of the AUI adapter cable to the AUI port on the router (Figure 2-2).
- Step 3** Connect the transceiver to the Ethernet LAN by using a BNC connector (Figure 2-2).

Step 4 Check the following LEDs:

- The transceiver power LED (the location depends on model)—On when power is supplied to the transceiver through the router.
- The LAN ACT LED (front panel)—Blinks when there is traffic on the Ethernet LAN.

Figure 2-2 AUI Port to Ethernet Transceiver Connection (Cisco 1601 Shown)

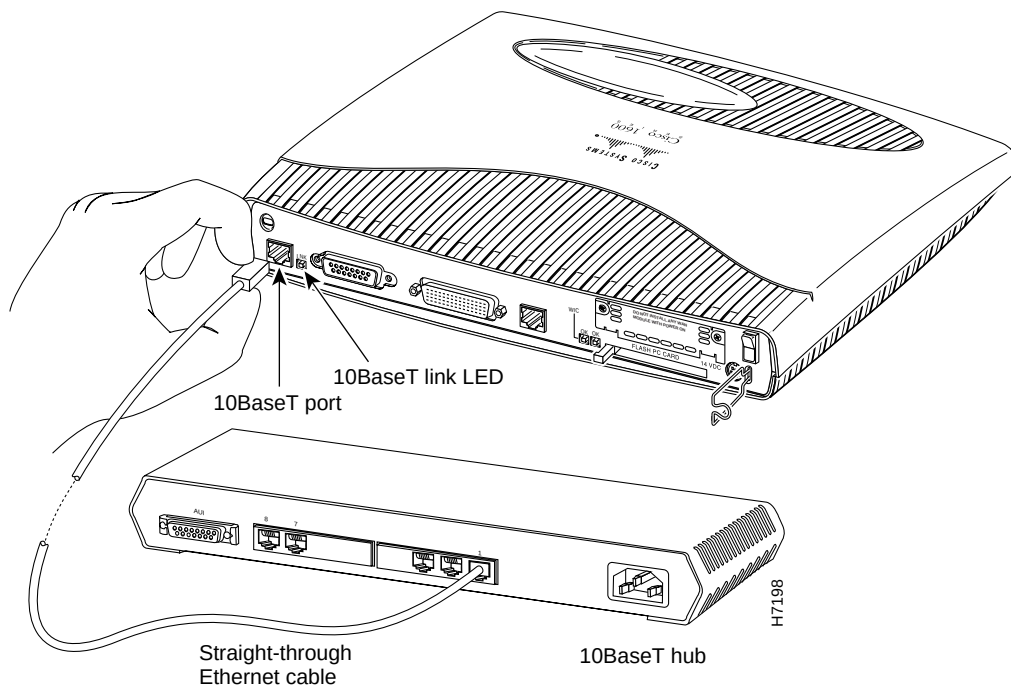


Connecting to a 10BaseT Ethernet

You must supply an Ethernet hub and an RJ-45-to-RJ-45 cable for this connection. Follow these steps to connect the router to a 10BaseT Ethernet LAN:

- Step 1** Connect one end of the Ethernet cable to the 10BASE T port.
- Step 2** Connect the other end of the cable to one of the ports on the 10BaseT hub.
- Step 3** Check the following LEDs:
 - LNK LED (rear panel, next to 10BaseT port)—On when the router is correctly connected to the 10BaseT Ethernet LAN.
 - LAN ACT LED (front panel)—On when there is traffic on the Ethernet LAN.

Figure 2-3 10BaseT Port to Ethernet Hub Connection (Cisco 1601 Shown)



Cisco 1605 LAN Connections

Unlike the other Cisco 1600 models, the Cisco 1605 can support two LAN connections (Figure 2-4).

The Cisco 1605 has two Ethernet 0 ports. However, you can use only one of the Ethernet 0 ports at any one time. A second Ethernet connection must always be on the ETHERNET 1 10BASE T port. The Ethernet ports can be used in one of these two combinations:

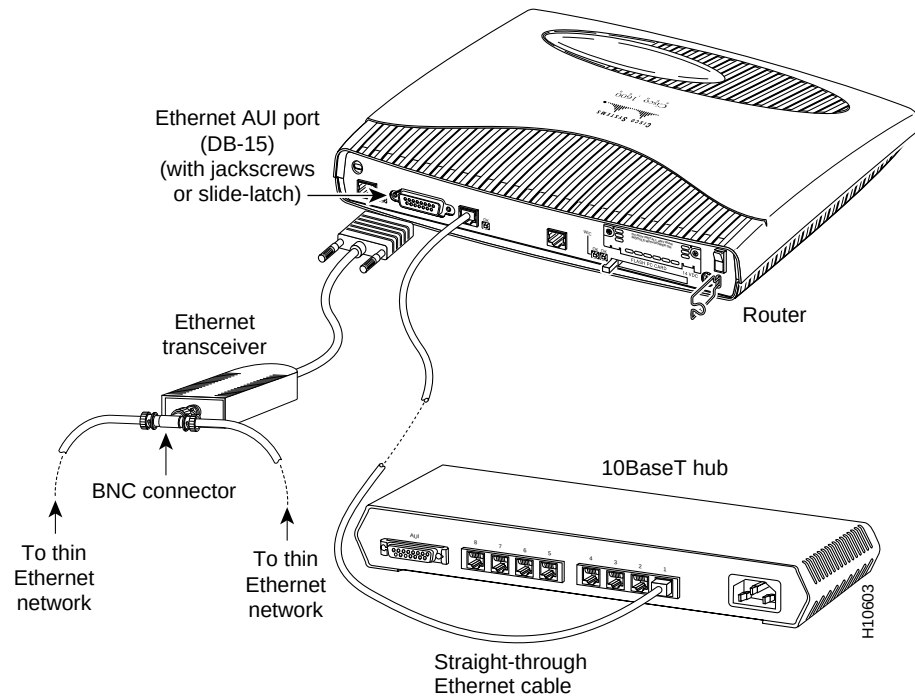
ETHERNET 0 10BASE T and ETHERNET 1 10BASE T

ETHERNET 0 AUI and ETHERNET 1 10BASE T

Make the LAN connections for the Cisco 1605 as you would any of the other models.

Connecting the Router to the LAN

Figure 2-4 Cisco 1605 with Two Ethernet LAN Connections



Connecting the Router to the WAN

Each Cisco 1600 series router supports a different type of WAN connection. This section describes how to make these WAN connections:

- Cisco 1601—Serial
- Cisco 1602—Data service unit/channel service unit (DSU/CSU)
- Cisco 1603—ISDN BRI S/T
- Cisco 1604—ISDN BRI U
- Cisco 1605—Refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that came with your WAN interface card.

Connecting the Cisco 1601 to the WAN

For this step, you must purchase a shielded serial transition cable from Cisco Systems. The router end of the shielded serial transition cable has a DB-60 connector. When you order the cable, specify the appropriate connector for your WAN interface.

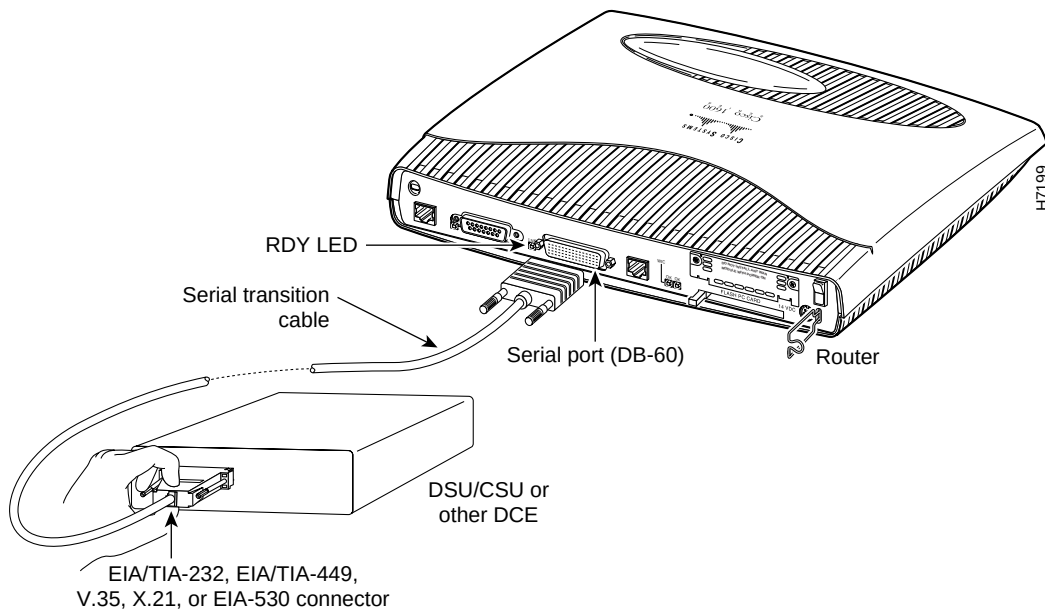
Note To ensure agency compliance with electromagnetic emissions requirements, such as electromagnetic interference (EMI), use only a shielded serial transition cable with the router.

Connecting the Router to the WAN

Follow these steps to connect the Cisco 1601 to the WAN:

- Step 1** Connect the cable DB-60 connector to the SERIAL 0 port on the Cisco 1601.
- Step 2** Connect the other end of the cable to one of the following devices:
- Asynchronous modem that you provide if connecting to an analog telephone line.
 - Synchronous modem, DSU/CSU, or other data circuit-terminating equipment (DCE) that you provide if connecting to a digital WAN line.
- Step 3** Check the RDY LED on the rear panel. It lights when the router is correctly connected to the modem or DSU/CSU. If the RDY LED is not on, refer to the “Troubleshooting” appendix later in this guide.

Figure 2-5 Serial Connection—Cisco 1601

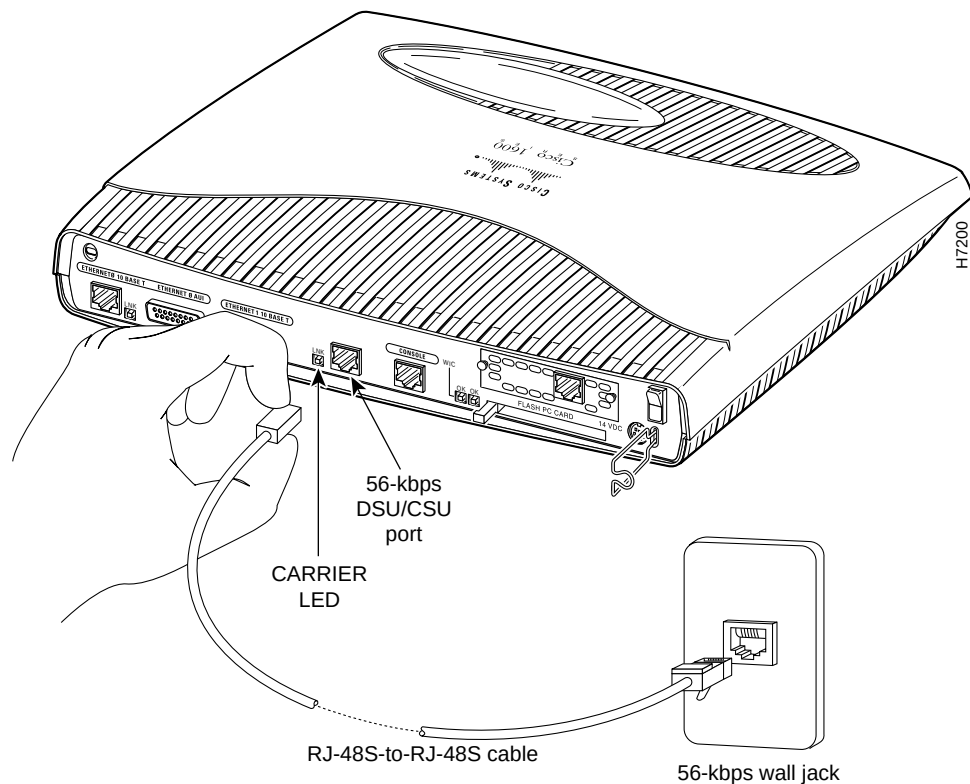


Connecting the Cisco 1602 to the WAN

You must provide either an RJ-48S-to-RJ-48S or an RJ-45-to-RJ-45 cable for this step. Follow these steps to connect the Cisco 1602 to the WAN:

- Step 1** Connect one end of the cable to the router SERIAL 0 56K DSU/CSU port.
- Step 2** Connect the other end of the cable to the 56-kbps wall jack (Figure 2-6).

Figure 2-6 56-kbps Service Connection—Cisco 1602



- Step 3** Check the CARRIER LED on the rear panel. It lights when the cable is correctly connected and the router has synchronized with the central office switch.

Connecting the Cisco 1603 to the WAN

You must provide a Network Termination 1 (NT1) device and a straight-through RJ-45-to-RJ-45 cable for this connection.



Warning Network hazardous voltages are present in the BRI cable. If you detach the BRI cable, detach the end away from the router first to avoid possible electric shock. Network hazardous voltages also are present on the system card in the area of the BRI port (RJ-45 connector), regardless of when power is turned off.

Depending on where the Cisco 1603 is being used, the ISDN BRI connection can be different. Follow these steps to connect the Cisco 1603 to the WAN:

- Step 1** Use an RJ-45-to-RJ-45 cable to connect the cable to the ISDN Ø S/T port on the router.
- Step 2** Do one of these steps:
- In North America—Connect the other end of the cable to the NT1 (Figure 2-7), and then connect the NT1 to the ISDN wall jack (Figure 2-8).
 - Outside North America—Connect the other end of the cable directly to the ISDN wall jack (Figure 2-8).

Figure 2-7 NT1 Connection—Cisco 1603

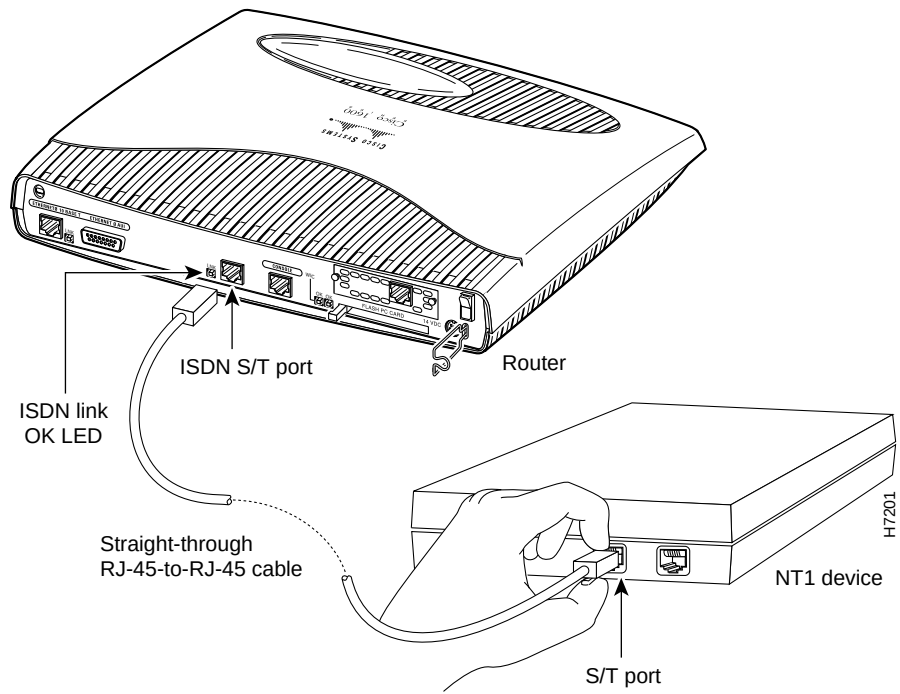
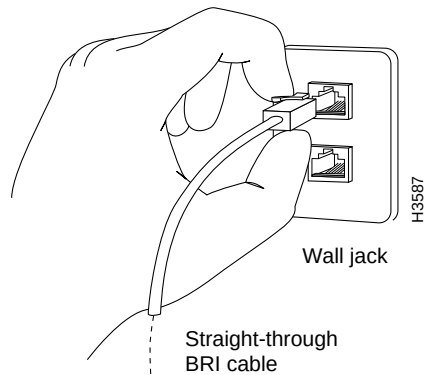


Figure 2-8 ISDN Wall Jack Connection—Cisco 1603



Warning Network hazardous voltages are present in the BRI cable. If you detach the BRI cable, detach the end away from the router first to avoid possible electric shock. Network hazardous voltages also are present on the system card in the area of the BRI port (RJ-45 connector), regardless of when power is turned off.

Step 3 Check the following LEDs:

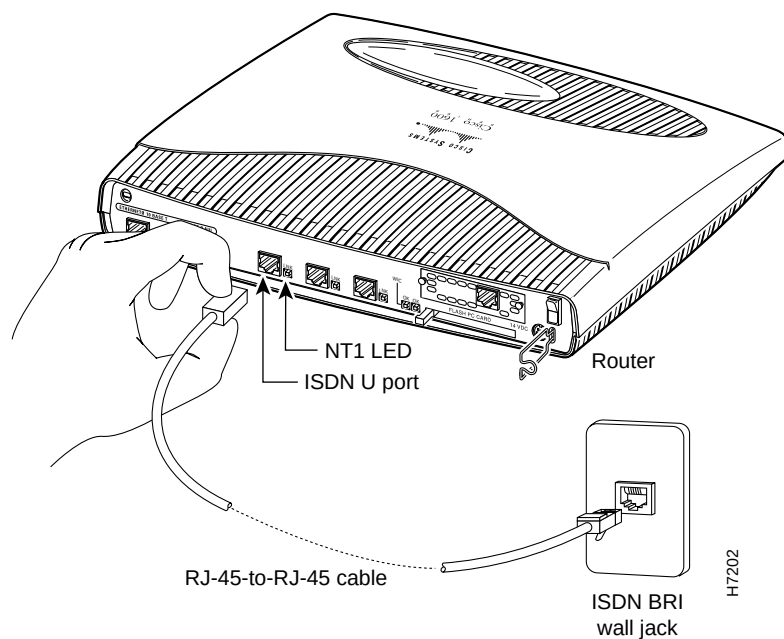
- The OK LED on the rear panel (next to ISDN S/T port) lights when the router has synchronized with the central office switch.
- The external NT1 might have an LED indicating synchronization with the central office switch or other NT1 status. Check the NT1 documentation.

Connecting the Cisco 1604 to the WAN

You must provide a straight-through cable, either RJ-11-to-RJ-11 or RJ-45-to-RJ-45, for this connection. Follow these steps to connect the Cisco 1604 to the WAN:

- Step 1** Connect one end of the cable to the ISDN Ø U port on the router.
- Step 2** Connect the other end of the cable directly to the ISDN BRI wall jack (Figure 2-9).

Figure 2-9 ISDN BRI Connection—Cisco 1604



- Step 3** The NT1 LED on the rear panel lights when the router has synchronized with the central office switch.

Connecting the Cisco 1605 to the WAN

The procedure for connecting the Cisco 1605 to the WAN depends on the type of WAN interface card that is installed in the router. For instructions for the card that you are using, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that came with your WAN interface card.

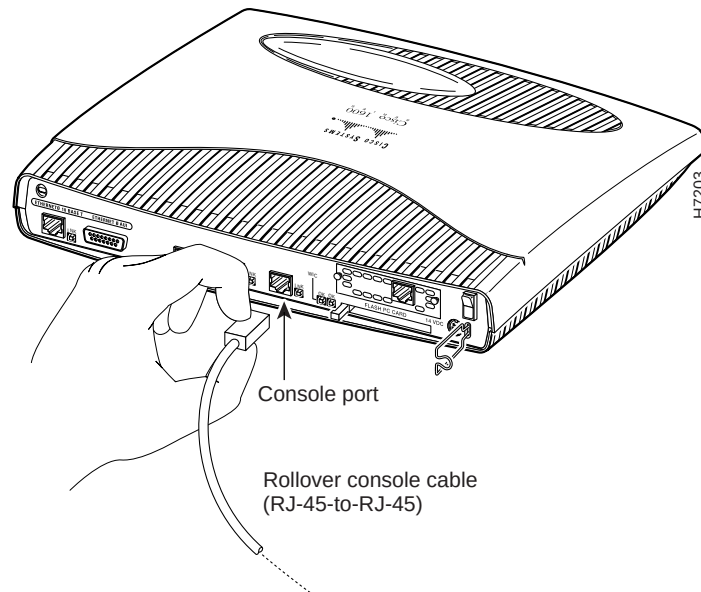
Connecting the Console Port

The cable and adapters required for this connection are included with the router. Follow these steps to connect the router to a terminal or PC:

- Step 1** Connect the light-blue console cable to the light-blue CONSOLE port on the router (Figure 2-10).
- Step 2** Use the correct adapter to connect the other end of the cable to your terminal or PC.

Note If your terminal or PC has a console port that does not fit one of the adapters, you must provide the correct adapter for that port.

Figure 2-10 **Connecting to Console Port**



You have completed the router installation and are ready to configure the router. Refer to the *Cisco 1600 Series Software Installation Guide* for more information about configuring your router.

Connecting the Console Port

Optional Installations

This chapter describes some procedures that you might not need for your router:

- Installing the WAN Interface Card in the Router
- Installing a Flash PC Card
- Connecting an ISDN Telephone to the Cisco 1604
- Wall-Mounting the Router

Installing a WAN Interface Card

Cisco 1600 series routers can support an additional WAN port on a one-port WAN interface card that is installed in the router. This chapter describes the supported WAN interface cards and describes the general procedure for installing any WAN interface card in any Cisco 1600 series router.

For information about installing and connecting a specific card, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that came with the card.

This procedure describes how to install a WAN interface card in a Cisco 1600 series router. This example use an ISDN BRI U card and a Cisco 1601 router. The same procedure is used to install any of the Cisco 1600-compatible cards in any Cisco 1600 series router.

Safety Information

This section lists safety warnings that you should be aware of before installing a WAN interface card in the router.



Warning Only trained and qualified personnel should be allowed to install or replace this equipment. (To see translated versions of this warning, refer to the document that accompanied the router.)



Warning Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals. (To see translated versions of this warning, refer to the document that accompanied the router.)



Warning Before opening the chassis, disconnect the telephone-network cables (from the card) to avoid contact with telephone-network voltages. (To see translated versions of this warning, refer to the document that accompanied the router.)



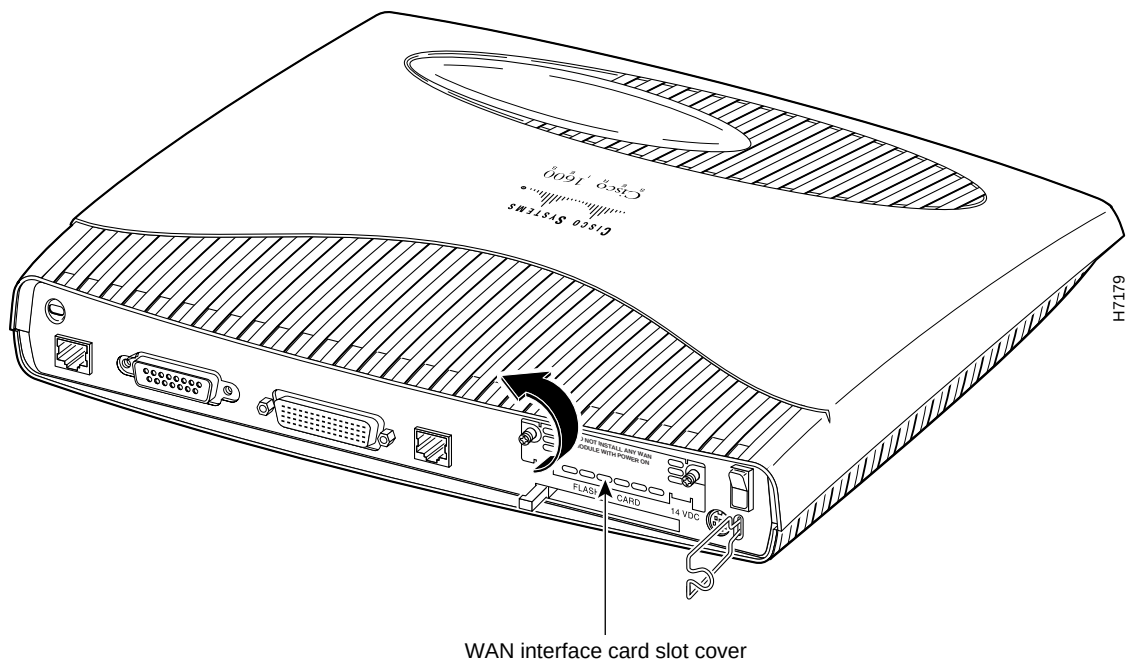
Warning Do not work on the system or connect or disconnect cables during periods of lightning activity. (To see translated versions of this warning, refer to the document that accompanied the router.)

Installing the WAN Interface Card in the Router

Follow these steps to install the card in a Cisco 1600 series router:

- Step 1** Turn the router OFF, and disconnect the cable from the socket labeled 14 VDC on the rear panel of the router.
- Step 2** Loosen the captive screws on the WAN interface card-slot cover on the rear panel of the router (Figure 3-1).

Figure 3-1 Removing the Slot Cover (Cisco 1601 Shown)



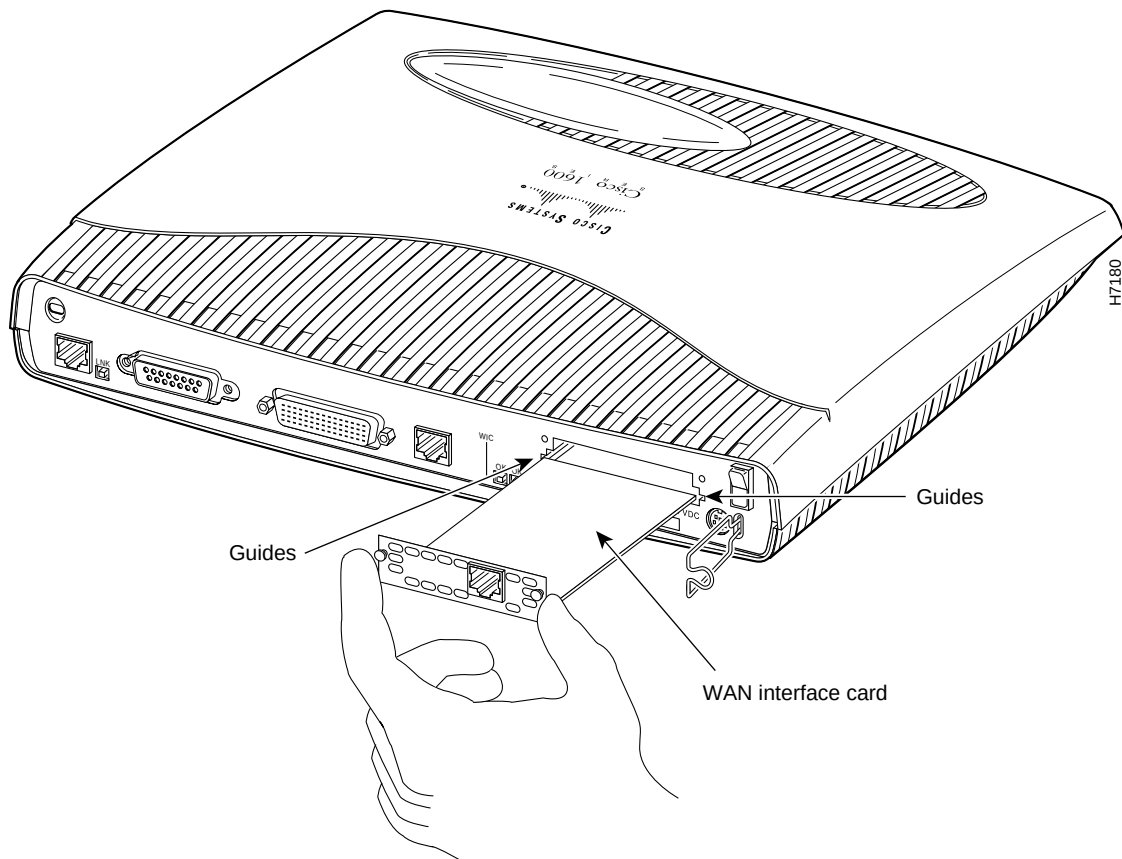
- Step 3** Remove the metal plate that covers the WAN interface card slot.
- Step 4** Hold the WAN interface card by the front panel, and line up the edges of the card with the guides (Figure 3-2).

Installing a WAN Interface Card



Caution Do not connect a WAN cable to the card until you have completed the installation procedure.

Figure 3-2 Installing the WAN Interface Card in the Router (Cisco 1601 and BRI U Card Shown)



Step 5 Insert the card in the slot and gently push it in until the front panel of the card is flush with the rear panel of the router.

Step 6 Tighten the card captive screws.

For more information about the card that you are using, refer to the *Cisco WAN Interface Cards Hardware Installation Guide* that came with the card.

Installing a Flash PC Card

This section explains how to install the Flash PC card. The Flash PC card is a writable card used to download new software to the router over the WAN.

Note Although the router is shipped from Cisco with the Flash PC card already installed, you might have to install it if someone has removed the card for any reason. For example, to configure your router, the system administrator might remove the card, add a configuration file to it, and then return it to you.

Follow these steps to install the Flash PC card:

- Step 1** Turn the router OFF.
- Step 2** Insert the connector end of the card in the router slot, aligning the card edges along the card-slot guides.
- Step 3** Push the Flash PC card into the slot (Figure 3-3) until the card is seated.

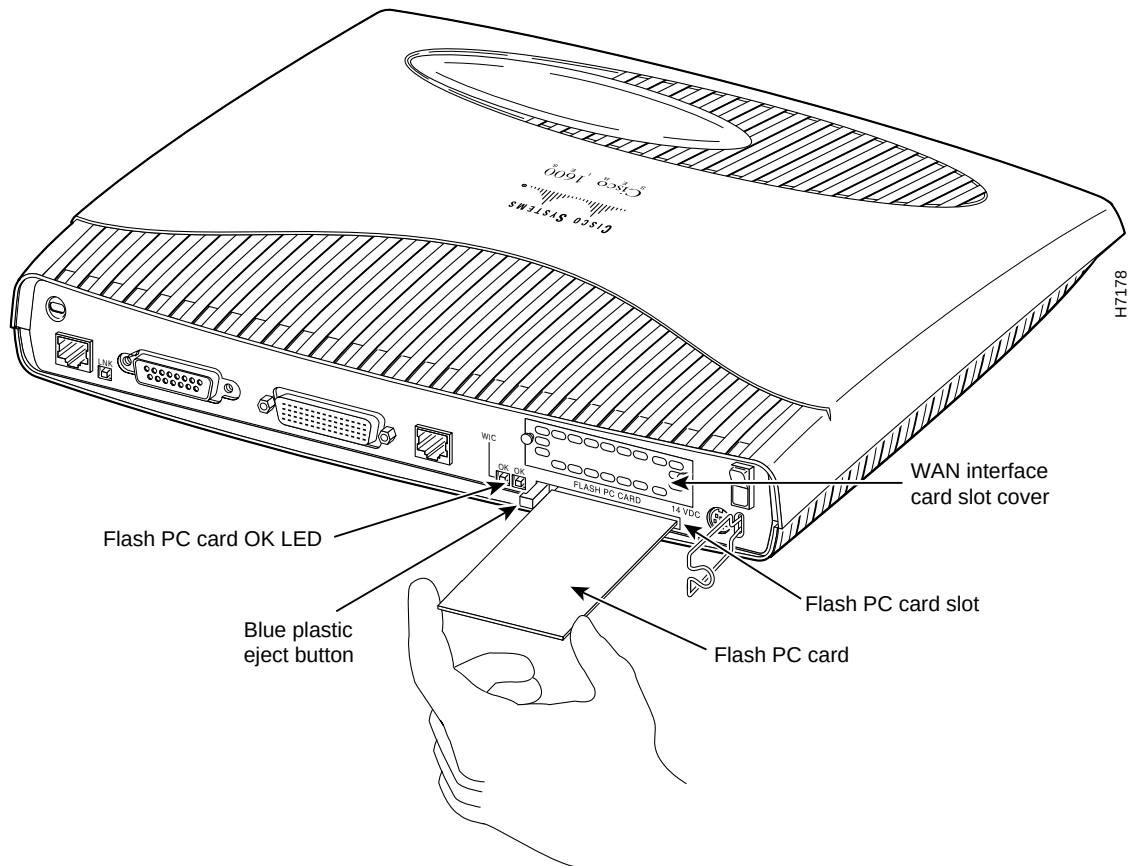
When the card is completely seated in the connector, the blue button left of the Flash PC card slot (Figure 3-3) pops out. If the blue button does not pop out, the card is not seated. Press the blue button, remove the card, and reinsert it.



Caution Do not remove the Flash PC card from RFF router models while the router is operating. The RFF models cannot operate without the Flash PC card.

Installing a Flash PC Card

Figure 3-3 Installing a Flash PC Card (Cisco 1601 Shown)



Note After you have powered up the router, you can check that the card is functioning correctly. Refer to the chapter “Installing the Router” earlier in this guide for information on how to power up the router.

Connecting an ISDN Telephone to the Cisco 1604

This section describes how to connect an ISDN telephone (or another ISDN device) to the ISDN PHONE port on the rear panel of the Cisco 1604. The ISDN PHONE port is only for connecting a second ISDN device. Routing cannot be performed over this port.

Note The router does not supply power to a device connected to the ISDN PHONE port. Any device connected to the ISDN PHONE port must have its own internal or external power supply.

Configuration Changes

When you are connecting a second ISDN device to the ISDN line through the router, you need to use subaddressing on the ISDN line.

For more information about using subaddressing, refer to the “ISDN BRI Line Configuration Requirements” section in the “Configuring the ISDN Line” appendix.

Before Installing the Telephone

This procedure in this section assumes that you have already connected the router ISDN Ø U port to the ISDN wall-jack as described in the “Connecting the Cisco 1604 to the WAN” section in the “Installing the Router” chapter earlier in this guide.

Installing the Telephone

This example procedure describes how to connect an AT&T ISDN telephone (model ISDN 8510T) and an AT&T external power supply (model MSP-1) that supplies power to this telephone. Depending on the model of telephone and power supply that you are installing, the procedure for connecting the telephone and power supply could differ slightly from the one shown in this section.

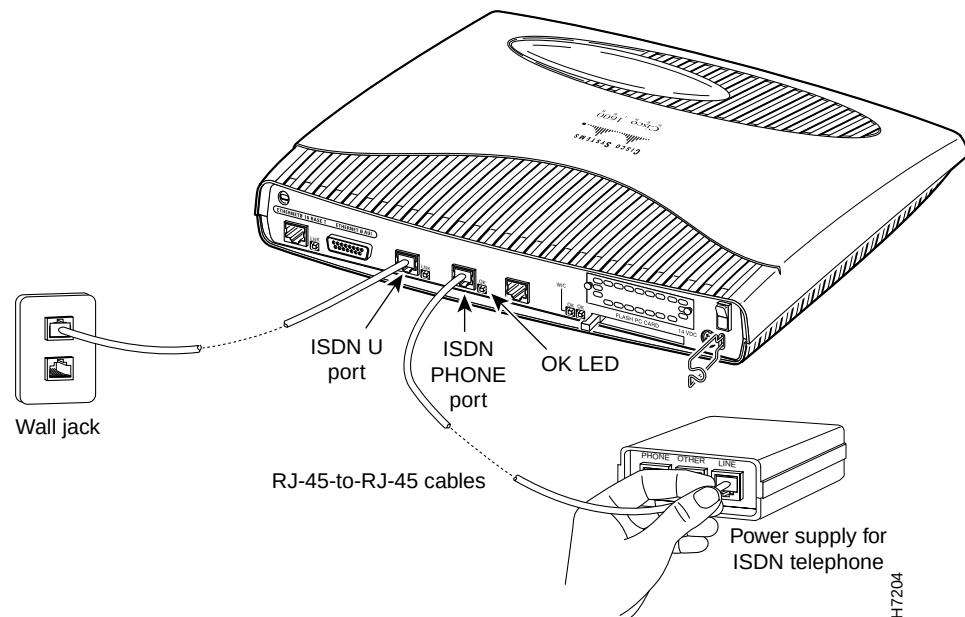
Connecting an ISDN Telephone to the Cisco 1604

Note If the ISDN telephone model you are using does not require an external power supply, connect the ISDN telephone RJ-45-to-RJ-45 cable directly to the router ISDN PHONE port.

Follow these steps to connect an ISDN telephone to the router:

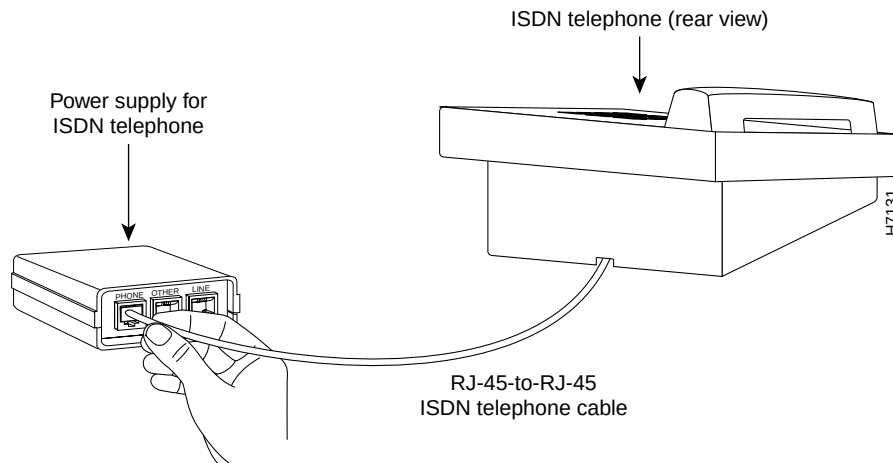
- Step 1** Connect an RJ-45-to-RJ-45 cable (included) to the ISDN PHONE on the router.
- Step 2** Connect the other end of the cable to the LINE port on the ISDN telephone power supply, as shown in Figure 3-4.

Figure 3-4 Connecting an ISDN Telephone Power Supply to a Cisco 1604



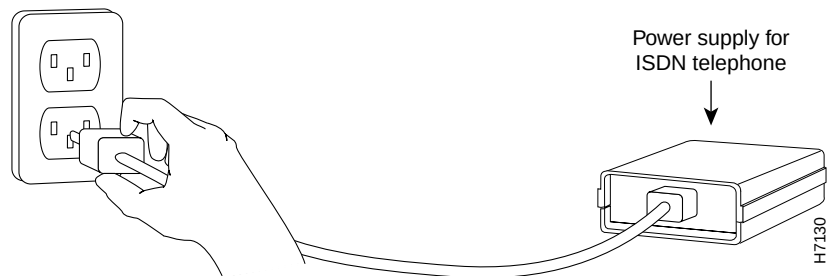
- Step 3** Connect the ISDN telephone RJ-45 cable to the PHONE port on the ISDN telephone power supply, as shown in Figure 3-5.

Figure 3-5 Connecting an ISDN Telephone to a Power Supply



Step 4 Connect the power supply cable to the power outlet, as shown in Figure 3-6.

Figure 3-6 Connecting an ISDN Telephone Power Supply to a Power Outlet



Step 5 The OK LED on the rear panel of the router (next to ISDN PHONE port) lights when the second ISDN device has synchronized with the central office switch.

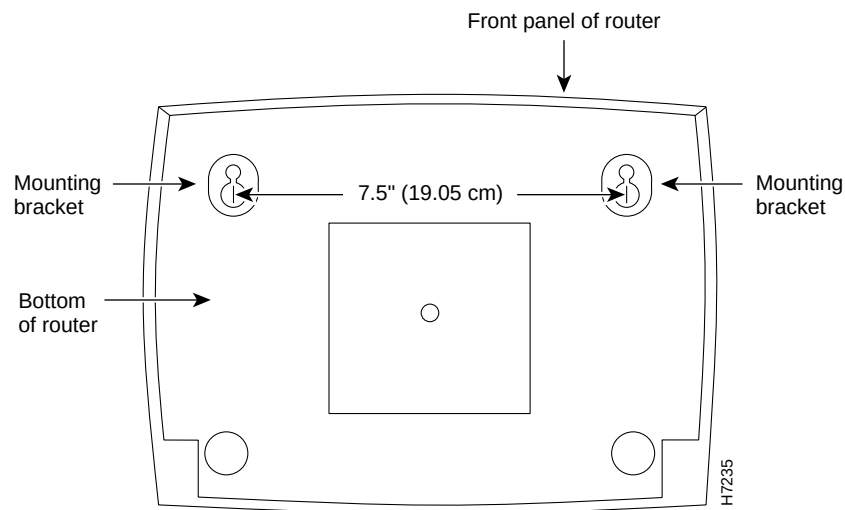
Wall-Mounting the Router

Cisco 1600 series routers can be wall-mounted by using two number-six, 3/4-inch screws (not included) and the molded mounting brackets on the bottom of the router (see Figure 3-7).



Caution If you install the screws in drywall, use hollow wall-anchors (1/8 inch by 5/16 inch) to secure the screws. If the screws are not properly anchored in wallboard or drywall, the strain of the network cable connections could pull the router from the wall.

Figure 3-7 Wall-Mount Brackets (Bottom of Router)

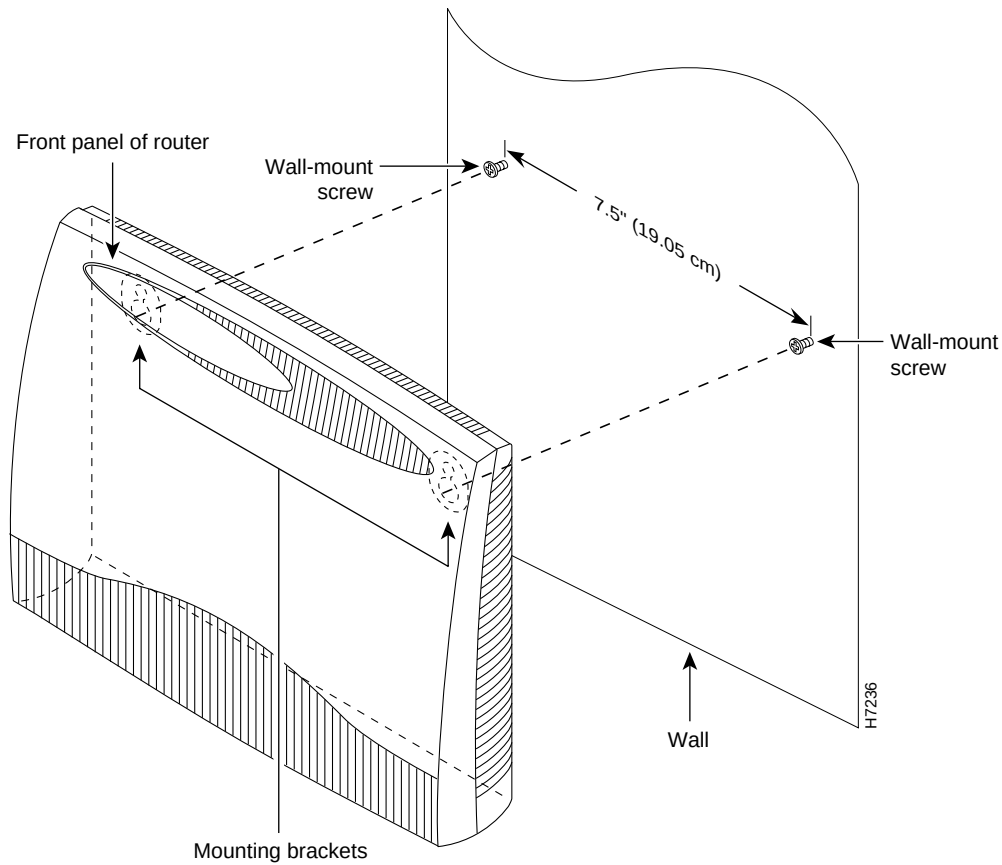


Follow these steps to mount the router on a wall or other vertical surface, as shown in Figure 3-8:

- Step 1** Install the two screws 7.5 inches (19.05 centimeters) apart on a wall or other flat surface.

- Step 2** Hang the router on the screws by the mounting brackets so that the following conditions are met:
- The front panel LEDs face upward and are easily visible. You will use these LEDs to verify that the router is operating properly. Mounting the router in this position also reduces strain on the network cable connections.
 - The desktop power supply does not hang from its cable. If the power supply is not supported, it will disconnect from its cable.

Figure 3-8 Mounting the Router on a Wall



Wall-Mounting the Router

Troubleshooting

Use this information to help isolate problems you might encounter with Cisco 1600 series routers or to rule out the router as the source of the problem.

This appendix contains the following sections:

- Recovering a Lost Enable Password
- Problem Solving
- Front Panel LEDs
- Rear Panel LEDs

For information about the Cisco 1600 series ROM monitor, refer to the “ROM Monitor” appendix in the *Cisco 1600 Series Software Configuration Guide* that came with your router.

If you cannot locate the source of the problem, contact your local reseller for advice. Before you call, have the following information ready:

- Chassis type and serial number
- Maintenance agreement or warranty information
- Type of software and version number
- Date you received the chassis
- Brief description of the problem
- Brief explanation of the steps you have taken to isolate the problem

Recovering a Lost Enable Password

This section describes how to recover a lost enable password.

Note You can recover a lost enable password, but not an enable secret password. This password is encrypted and must be replaced with a new enable secret password. See the “Hot Tips” section on Cisco Connection Online (CCO) for information on replacing enable secret passwords.

Follow these steps to recover a lost enable password:

- Step 1** Connect an ASCII terminal or a PC running a terminal-emulation program to the CONSOLE port on the rear panel of the router. Refer to the section “Connecting the Console Port” in the “Installing the Router” chapter.
- Step 2** Configure the terminal to operate at 9600 baud, 8 data bits, no parity, and 1 stop bit.
- Step 3** Reboot the router.
- Step 4** At the user EXEC prompt (Router>), enter the **show version** command to display the existing configuration register value:
- ```
Router> show version
```
- Step 5** Record the setting of the configuration register. It is usually 0x2102 or 0x102.
- Step 6** Record the break setting.
- Break enabled—bit 8 is set to 0.
  - Break disabled (default setting)—bit 8 is set to 1.

---

**Note** To enable break, enter the **config-register 0x01** EXEC command.

---

- Step 7** Do one of the following:
- If break is enabled, go to Step 8.
  - If break is disabled, turn the router OFF, wait 5 seconds, and turn it ON again. Within 60 seconds, press the **Break** key. The terminal displays the ROM monitor prompt. Go to Step 9.

---

**Note** Some terminal keyboards have a key labeled Break. If your keyboard does not have a Break key, refer to the documentation that came with the terminal for instructions on how to send a break.

---

- Step 8** Send a break. The terminal displays the following prompt:

```
rommon 2>
```

- Step 9** Enter **confreg 0x142** as follows to reset the configuration register:

```
rommon 2> confreg 0x142
```

- Step 10** Initialize the router by entering the **initialize** command:

```
rommon 2> initialize
```

The router cycles its power, and the configuration register is set to 0x142. The router uses the boot ROM system image, indicated by the system configuration dialog:

```
--- System Configuration Dialog ---
```

- Step 11** Enter **no** in response to the prompts until the following message is displayed:

```
Press RETURN to get started!
```

- Step 12** Press **Return**. The following prompt appears:

```
Router>
```

## Recovering a Lost Enable Password

---

**Step 13** Enter the **enable** command to enter enable mode. Configuration changes can be made only in enable mode:

```
Router> enable
```

The prompt changes to the privileged EXEC prompt:

```
Router#
```

**Step 14** Enter the **show startup-config** command to display the enable password in the configuration file:

```
Router# show startup-config
```

**Step 15** Enter the **configure terminal** command to enter configuration mode:

```
Router# configure terminal
```

**Step 16** Enter the **configure register** command to reset the configuration register to the original value that you recorded in Step 5.

**Step 17** Press **Ctrl-Z** to exit configuration mode.

---

**Note** To return to the configuration being used before recovering the lost enable password, do not save the configuration changes before rebooting the router.

---

**Step 18** Reboot the router, and enter the recovered password.

## Problem Solving

The key to problem solving is to isolate the problem to a specific subsystem by comparing what the router is doing to what it should be doing.

When problem solving, consider the following subsystems of the router:

- WAN interface cards—Refer to the LEDs on the cards and the LEDs on the router front panel to help identify a failure. For information on the front panel LEDs, refer to the “Front Panel LEDs” section later in this appendix.
- Cables—Check all the external cables that connect the router to the network.
- Power system—Consider the external power source, power cable, router power supply, and circuit breaker. Check for inadequate ventilation or air circulation.
- ISDN configuration—Consider ISDN-specific hardware and software configurations (Cisco 1603, Cisco 1604, and ISDN BRI WAN interface cards only).

## Troubleshooting WAN Interface Cards and Cables

Check for the following symptoms to help isolate the problem:

- WAN interface card is not recognized by the router.
  - Make sure that the card is correctly installed in the router. Refer to the “Installing a WAN Interface Card” section in the “Optional Installations” chapter.
  - Check the LEDs on the card and on the front panel of the router.
  - If you are using a Cisco 1603 or Cisco 1604, check that the router does not have a ISDN S/T or an ISDN U card installed.
- WAN interface card is recognized, but interface ports do not initialize.
  - Make sure that the card is correctly installed in the router. Refer to the “Installing a WAN Interface Card” section in the “Optional Installations” chapter.
  - Check the external cable connections to make sure they are secure.
- Router does not boot properly or constantly or intermittently reboots.
  - Make sure that the card is correctly installed in the router. Refer to the “Installing a WAN Interface Card” section in the “Optional Installations” chapter.

## Problem Solving

---

- Make sure that the Flash PC card is correctly installed in the router. For more information on installing the card, refer to the “Installing a Flash PC Card” section in the “Optional Installations” chapter.
- Router boots, but the console screen is frozen.
  - Check the external console connection and make sure it is secure.
  - Verify that the parameters for your terminal are set to the following:
    - 9600 baud
    - 8 data bits
    - No parity generated or checked
    - 1 stop bit
- Router powers on and boots only when a particular WAN interface card is removed from the router.
  - Replace the card. Consult your reseller or local Cisco sales office for warranty information.
  - If you are using a Cisco 1603 or Cisco 1604, check that the router does not have a ISDN S/T or an ISDN U card installed.
- Router powers on and boots only when a particular cable is disconnected.
  - There might be a problem with the WAN interface card or card cables. Consult your reseller or local Cisco sales office for warranty information.

## Troubleshooting the Power System

If the router external power supply fails, it should be returned to Cisco. Check the following items to help isolate the problem:

- Router shuts down after being on a short time.
  - Check the environmental site requirements in the “Site Requirements” section in the *Regulatory Compliance and Safety Information for Cisco 1600 and Cisco 1700 Routers* document that came with your router.
  - If the front-panel SYSTEM PWR LED is not on, the power supply has failed.
- If the router partially boots, but all LEDs remain off, the power supply has failed.
- If the router is on, but the front-panel SYSTEM PWR LED is off, the power supply has failed.
- If the front-panel SYSTEM PWR LED is on, the front-panel SYSTEM OK LED is off, and the router does not pass console or EIA data, the power supply has failed.

## Troubleshooting ISDN

This section describes problems related to the ISDN line that might occur.

Two commands are useful when troubleshooting ISDN:

- For routers with an ISDN S/T interface, enter the **clear interface bri0** command to terminate any active ISDN calls and to reset the ISDN BRI interface:  
  
Router# **clear interface bri0**
- For routers with an ISDN U interface, enter the **clear controller bri0** command to terminate any active ISDN calls, to reset the ISDN BRI interface, and to reset the ISDN line between the router and the central office switch:

Router# **clear controller bri0**

## Troubleshooting ISDN

---

Figure A-1 lists troubleshooting methods for ISDN-specific problems that might occur.

**Figure A-1**      **Troubleshooting ISDN**

| Symptom                                                                                                 | Checks                                                                                                                                                                                       | Causes and Solutions                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Router is on:<br>OK LED (next to ISDN S/T port) is off<br>(Cisco 1603 and ISDN S/T WAN interface card). | <ul style="list-style-type: none"><li>• Is the SYSTEM OK LED on?</li><li>• Are all ISDN cables properly connected?</li><li>• Is the NT1 LED on?</li></ul>                                    | <ul style="list-style-type: none"><li>• Possible router hardware problem.</li><li>• Possible ISDN line problem. Check with ISDN service provider.</li><li>• Possible NT1 problem.</li></ul>                                         |
| Router is on:<br>NT1 LED is off<br>(Cisco 1604 and ISDN U WAN interface card).                          | <ul style="list-style-type: none"><li>• Is the SYSTEM OK LED on?</li><li>• Are all ISDN cables properly connected?</li><li>• Is the ISDN line connected to the router ISDN U port?</li></ul> | <ul style="list-style-type: none"><li>• Possible router hardware problem.</li><li>• Possible ISDN line problem. Check with ISDN service provider.</li><li>• Possible ISDN line problem. Check with ISDN service provider.</li></ul> |

**Figure A-1 Troubleshooting ISDN (Continued)**

| Symptom                                                                                                                 | Checks                                                                                                                                                                                                                          | Causes and Solutions                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NT1 LED is on.<br>OK LED (next to ISDN S/T port) is off<br>(Cisco 1604).                                                | <ul style="list-style-type: none"> <li>• If there is no device connected to the ISDN S/T port, the OK LED should be off.</li> <li>• Is the device connected to the ISDN S/T port turned on and correctly configured?</li> </ul> | <ul style="list-style-type: none"> <li>• Possible router hardware problem.</li> <li>• Possible problem with device connected to the ISDN S/T port.</li> </ul>                                                |
| Cisco 1604 cannot create an ISDN connection to the remote router when an ISDN device is connected to the ISDN S/T port. | <ul style="list-style-type: none"> <li>• Is the ISDN configured for multipoint service?</li> <li>• Is the external ISDN device using both B channels?</li> </ul>                                                                | <ul style="list-style-type: none"> <li>• The service provider should configure the line for multipoint service.</li> <li>• The service provider should configure the line for multipoint service.</li> </ul> |
| ISDN device attached to the Cisco 1604 ISDN S/T port does not operate correctly.                                        | <ul style="list-style-type: none"> <li>• Does the device operate correctly if the interface for the Cisco 1604 ISDN U port (interface bri0) is shut down?</li> <li>• Is the Cisco 1604 using both B channels?</li> </ul>        | <ul style="list-style-type: none"> <li>• The service provider should configure the line for multipoint service.</li> <li>• The service provider should configure the line for multipoint service.</li> </ul> |

## Troubleshooting ISDN

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**Figure A-1**      **Troubleshooting ISDN (Continued)**

| Symptom                                                                                             | Checks                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Causes and Solutions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cannot make an ISDN connection to remote device (Cisco 1603, Cisco 1604, ISDN WAN interface cards). | <ul style="list-style-type: none"><li>• Use <b>show status</b> command to check the following:<ul style="list-style-type: none"><li>— Does the current ISDN switch type match actual switch type being used?</li></ul></li><li>• Check the following:<ul style="list-style-type: none"><li>— Is Layer 1 status deactivated?</li><li>— If Layer 1 status is active, does Layer 3 status say “2 Active Layer 3 calls”?</li><li>— If Layer 1 status is active, does Layer 3 status say “No Active Layer 3 call(s)”?</li><li>— If Layer 1 status is active, does Layer 3 status say “1 Active Layer 3 call”?</li></ul></li></ul> | <ul style="list-style-type: none"><li>• Use the <b>isdn switch-type</b> command to configure correct switch type.</li><li>• Use the <b>show controller bri0</b> command to check for the messages CO RUNNING LOOPBACK TESTS or CO TESTING. If you receive these messages, contact the service provider.</li><li>• Router might have called itself. Check destination phone number configured with the <b>dialer map</b> command and the <b>dialer string</b> command.</li><li>• Check destination phone number. Check route to the destination.</li><li>• Check router protocol configurations.</li></ul> |

## Front Panel LEDs

You can use the LEDs on the front panel of the router to determine router performance and operation. This section contains information about reading the LEDs and using them to troubleshoot problems.

**Figure A-2 Front Panel LEDs—Cisco 1601 and Cisco 1602**

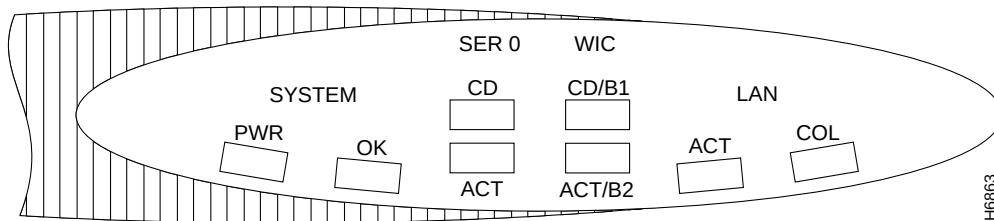


**Table A-1 Front Panel LED Functions—Cisco 1601 and Cisco 1602**

| LED        | Color  | Description                                                                                                                                                                                      |
|------------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SYSTEM PWR | Green  | The router is on, and DC power is being supplied.                                                                                                                                                |
| SYSTEM OK  | Green  | The router has successfully booted. Blinks during the boot cycle.                                                                                                                                |
| LAN ACT    | Green  | Data is being sent to or received from the local Ethernet LAN.                                                                                                                                   |
| LAN COL    | Yellow | Flashing indicates packet collisions on the local Ethernet LAN.                                                                                                                                  |
| SER 0 CD   | Green  | <ul style="list-style-type: none"> <li>Cisco 1601 has an active connection on the serial port.</li> <li>Cisco 1602 has an active connection on the DSU/CSU port.</li> </ul>                      |
| SER 0 ACT  | Green  | <ul style="list-style-type: none"> <li>Cisco 1601 serial port is sending or receiving data.</li> <li>Cisco 1602 DSU/CSU port is sending or receiving data.</li> </ul>                            |
| WIC CD/B1  | Green  | <ul style="list-style-type: none"> <li>Serial WAN interface card has an active connection on the serial port.</li> <li>ISDN WAN interface card has an ISDN connection on B-channel 1.</li> </ul> |
| WIC ACT/B2 | Green  | <ul style="list-style-type: none"> <li>WAN interface card serial port is sending or receiving data.</li> <li>WAN interface card ISDN port has a connection on B-channel 2.</li> </ul>            |

## Front Panel LEDs

**Figure A-3** Front Panel LEDs—Cisco 1603 and Cisco 1604

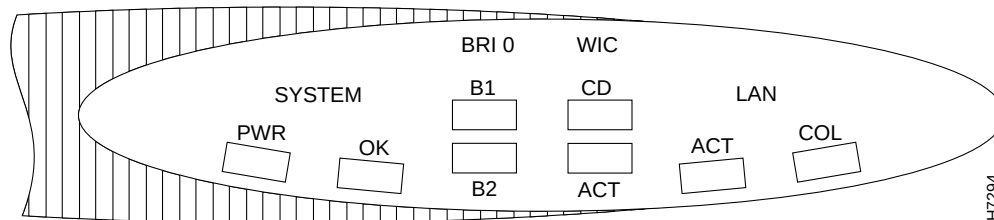
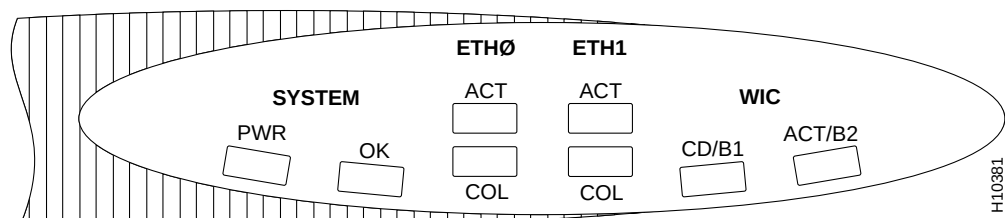


**Table A-2** Front Panel LED Functions—Cisco 1603 and Cisco 1604

| LED        | Color  | Description                                                                                                                                    |
|------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------|
| SYSTEM PWR | Green  | The router is turned on, and DC power is being supplied.                                                                                       |
| SYSTEM OK  | Green  | The router has successfully booted. Blinks during the boot cycle.                                                                              |
| LAN ACT    | Green  | Data is being sent to or received from the local Ethernet LAN.                                                                                 |
| LAN COL    | Yellow | Flashing indicates packet collisions on the local Ethernet LAN.                                                                                |
| BRI 0 B1   | Green  | An ISDN connection on B-channel 1.<br>Cisco 1604 only—If an ISDN device connected to the ISDN S/T port is using B-channel 1, the LED turns on. |
| BRI 0 B2   | Green  | An ISDN connection on B-channel 2.<br>Cisco 1604 only—If an ISDN device connected to the ISDN S/T port is using B-channel 2, the LED turns on. |
| WIC CD     | Green  | Active connection on the WAN interface card serial port.                                                                                       |
| WIC ACT    | Green  | Data is being sent over the WAN interface card serial port.                                                                                    |

**Figure A-4 Front Panel LEDs—Cisco 1605****Table A-3 Front Panel LED Functions—Cisco 1605**

| LED        | Color  | Description                                                         |
|------------|--------|---------------------------------------------------------------------|
| SYSTEM PWR | Green  | The router is turned on, and DC power is being supplied.            |
| SYSTEM OK  | Green  | The router has successfully booted. Blinks during the boot cycle.   |
| ETH0 ACT   | Green  | Data is being sent to or received from the first Ethernet LAN.      |
| ETH0 COL   | Yellow | Flashing indicates packet collisions on the first Ethernet LAN.     |
| ETH1 ACT   | Green  | Data is being sent to or received from the second Ethernet LAN.     |
| ETH1 COL   | Yellow | Flashing indicates packet collisions on the second Ethernet LAN.    |
| WIC CD/B1  | Green  | Data is being sent to or received from the WAN interface card port. |
| WIC ACT/B2 | Green  | Data is being sent to or received from the WAN interface card port. |

## Rear Panel LEDs

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## Rear Panel LEDs

Table A-4 describes the rear panel LEDs. For illustrations of these LEDs and the rear panel of the routers, refer to Figure 1-2 through Figure 1-5 in the “Overview of the Router” chapter.

**Table A-4**      **Rear Panel LED Functions**

| LED                                | Color  | Description                                                                                                                                                                                  |
|------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>All Models</b>                  |        |                                                                                                                                                                                              |
| LNK<br>(next to ETHERNETØ 10BASET) | Green  | Indicates 10BaseT link integrity. This LED is not on when connected to an Ethernet network through the AUI port.<br><br>The Cisco 1605 has two LNK LEDs, one for each Ethernet 10BaseT port. |
| OK<br>(next to FLASH PC CARD slot) | Green  | The Flash PC card is correctly installed.                                                                                                                                                    |
| <b>Cisco 1601</b>                  |        |                                                                                                                                                                                              |
| RDY                                | Green  | A serial port cable connection has been made to a modem or DSU/CSU.                                                                                                                          |
| <b>Cisco 1602</b>                  |        |                                                                                                                                                                                              |
| LOOPBACK                           | Yellow | The DSU/CSU is in DSU or CSU loopback mode.                                                                                                                                                  |
| ALARM                              | Yellow | An alarm condition exists on the DSU/CSU port.                                                                                                                                               |
| CARRIER                            | Green  | Indicates line synchronization or connection on the DSU/CSU port.                                                                                                                            |
| <b>Cisco 1603</b>                  |        |                                                                                                                                                                                              |
| OK<br>(next to ISDN BRIØ S/T port) | Green  | A physical connection has been established with the ISDN central office switch.                                                                                                              |

**Table A-4**      **Rear Panel LED Functions (Continued)**

| LED                                | Color | Description                                                                                                                 |
|------------------------------------|-------|-----------------------------------------------------------------------------------------------------------------------------|
| <b>Cisco 1604</b>                  |       |                                                                                                                             |
| NT1                                | Green | A physical connection has been established from the router internal NT1 to the ISDN central office switch.                  |
| OK (next to ISDN PHONE port)       | Green | The device connected to the router ISDN S/T port has established a physical connection with the ISDN central office switch. |
| <b>Cisco 1605</b>                  |       |                                                                                                                             |
| LNK<br>(next to ETHERNET1 10BASET) | Green | Indicates 10BaseT link integrity for the Ethernet 1 port.                                                                   |
| OK<br>(next to WIC slot)           | Green | The WAN interface card is correctly installed in the router.                                                                |

## Rear Panel LEDs

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# Configuring the ISDN Line

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This appendix describes how to order and configure an Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI) line for use with a Cisco 1600 series router with an ISDN BRI interface or a Cisco 1600 series router with an ISDN BRI WAN interface card installed.

This appendix contains the following sections:

- ISDN BRI Line Configuration Requirements
- ISDN BRI Switch Types
- ISDN BRI Provisioning by Switch Type
- Defining ISDN Service Profile Identifiers
- ISDN Configuration Options

## ISDN BRI Line Configuration Requirements

Before using a Cisco 1600 series router with an ISDN BRI interface or a Cisco 1600 series router with an ISDN BRI WAN interface card installed, you must order a correctly configured ISDN BRI line from your local telecommunications service provider.

This process varies significantly from provider to provider on a national and international basis. However, following are some general guidelines:

- Ask for two channels to be called by one number.
- Ask for delivery of calling line identification. This is also known as *Caller ID* or *Automatic Number Identification* (ANI).

## ISDN BRI Switch Types

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- If the router is going to be the only device attached to the ISDN BRI line, ask for point-to-point service and a data-only line.
- If you will be connecting another ISDN device (such as an ISDN telephone) to the ISDN BRI line through the router, ask for point-to-multipoint service (subaddressing is required) and a voice-and-data line.

## ISDN BRI Switch Types

ISDN BRI supports a variety of service provider switches. Table B-1 lists, by geographic areas, the ISDN switch types supported by the Cisco 1600 series routers ISDN BRI interface. When configuring the router, use the **isdn switch-type** command followed by the corresponding keyword.

**Table B-1** ISDN BRI Switch Types

| Switch Type                        | Keywords            |
|------------------------------------|---------------------|
| <b>Australia</b>                   |                     |
| Australian TS013 switches          | <b>basic-ts013</b>  |
| <b>Europe</b>                      |                     |
| German 1TR6 ISDN switches          | <b>basic-1tr6</b>   |
| Norway NET3 switches (phase 1)     | <b>basic-nwnet3</b> |
| NET3 ISDN switches (UK and others) | <b>basic-net3</b>   |
| French VN2 ISDN switches           | <b>vn2</b>          |
| French VN3 ISDN switches           | <b>vn3</b>          |
| <b>Japan</b>                       |                     |
| Japanese NTT ISDN switches         | <b>ntt</b>          |

**Table B-1** ISDN BRI Switch Types (Continued)

| Switch Type                    | Keywords            |
|--------------------------------|---------------------|
| <b>North America</b>           |                     |
| AT&T basic rate switches       | <b>basic-5ess</b>   |
| NT DMS-100 basic rate switches | <b>basic-dms100</b> |
| National ISDN-1 switches       | <b>basic-ni1</b>    |
| <b>New Zealand</b>             |                     |
| New Zealand Net3 switches      | <b>basic-nznet3</b> |

## ISDN BRI Provisioning by Switch Type

The ISDN BRI line is configured (*provisioned*) for different types of services by the ISDN BRI service provider. The person ordering the ISDN line must also order the provisioning described in this section.

Table B-2 lists the provisioning that should be ordered for the router, based on the switch type.

**Table B-2** ISDN Provisioning by Switch Type

| Switch Type            | Provisioning                                                                                                                                                                                                                                                                               |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>5ESS Custom BRI</b> | <b>For data only</b><br>Two B channels for data.<br>Point to point.<br>Terminal type = E.<br>One directory number (DN) assigned by service provider.<br>MTERM = 1.<br>Request delivery of calling line ID on Centrex lines.<br>Set speed for ISDN calls to 56 kbps outside local exchange. |

## ISDN BRI Provisioning by Switch Type

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**Table B-2 ISDN Provisioning by Switch Type (Continued)**

| Switch Type                   | Provisioning                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5ESS Custom BRI               | <b>For voice and data</b><br>(Use these values only if you have an ISDN telephone connected.)<br>Two B channels for voice or data.<br>Multipoint.<br>Terminal type = D.<br>Two directory numbers assigned by service provider.<br>Two service profile identifiers (SPIDs) required, assigned by service provider.<br>MTERM = 2.<br>Number of call appearances = 1.<br>Display = No.<br>Ringing/idle call appearances = idle.<br>Autohold= no.<br>Onetouch = no.<br>Request delivery of calling line ID on Centrex lines.<br>Set speed for ISDN calls to 56 kbps outside local exchange.<br>Directory number 1 can hunt to directory number 2. |
| 5ESS National ISDN (NI-1) BRI | Terminal type = A.<br>Two B channels for voice and data.<br>Two directory numbers assigned by service provider.<br>Two SPIDs required; assigned by service provider.<br>Set speed for ISDN calls to 56 kbps outside local exchange.<br>Directory number 1 can hunt to directory number 2.                                                                                                                                                                                                                                                                                                                                                     |
| DMS-100 BRI                   | Two B channels for voice and data.<br>Two directory numbers assigned by service provider.<br>Two SPIDs required; assigned by service provider.<br>Functional signaling.<br>Dynamic terminal endpoint identifier (TEI) assignment.<br>Maximum number of keys = 64.<br>Release key = no, or key number = no.<br>Ringing indicator = no.<br>EKTS = no.<br>PVC = 2.<br>Request delivery of calling line ID on Centrex lines.<br>Set speed for ISDN calls to 56 kbps outside local exchange.<br>Directory number 1 can hunt to directory number 2.                                                                                                 |

## Defining ISDN Service Profile Identifiers

An ISDN service provider, usually a telephone company, can offer a variety of services. Many providers use service profile identifiers (SPIDs) to identify the device that is using the ISDN service, similar to the way that the telephone company uses a telephone number to identify your standard telephone service. If you use a service provider that requires SPIDs, the provider assigns your ISDN device one or more SPIDs when you first subscribe to the service. Providers use different numbering schemes, but a SPID is usually a seven-digit telephone number, plus some optional numbers. The provider also assigns your device one or two local directory numbers (LDNs), which function as the router telephone numbers. The LDN is the number that a remote router dials to make a call to the router.

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**Note** SPIDs have significance only at the local-access ISDN interface. The remote router is assigned a SPID when the ISDN BRI services are ordered for that router.

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When your ISDN device accesses the switch to initialize the connection, first it must send any assigned SPID(s) to the service provider. Otherwise, your ISDN device cannot place or receive calls. Use the **isdn spid** command to define the SPID and the LDN on the router for both ISDN BRI B channels, as follows:

```
Router(config-if)# isdn spid1 spid-number [ldn]
```

```
Router(config-if)# isdn spid2 spid-number [ldn]
```

---

**Note** Although the LDN is usually optional, it might be required so that the router answers calls made to the second directory number.

---

## ISDN Configuration Options

For information on how to configure Cisco 1600 series routers to dial into a central site router over ISDN, refer to the *Cisco 1600 Series Software Configuration Guide* that came with your router.

For more advanced information on configuring ISDN for Cisco 1600 series routers, refer to the chapter “Configuring ISDN” in the *Wide-Area Networking Configuration Guide* publication, which is on the Documentation CD-ROM that came with your router. This document includes the information on the following topics:

- Defining ISDN TEI Negotiation
- Configuring Calling Line Identification (CLI) Screening
- Configuring Called Party Number Verification
- Configuring ISDN Calling Number Identification
- Configuring the Line Speed for Calls Not ISDN End-To-End
- Enabling PPP on VTY Lines
- Configuring Encapsulation for Frame Relay or X.25 Networks
- Configuring Network Addressing
- Configuring Semipermanent Connections (optional, for Germany only)
- Performing Configuration Self-Tests
- Monitoring and Maintaining ISDN Interfaces

## Snapshot Routing over ISDN

You can also configure *snapshot routing* for the router ISDN interface. Snapshot routing is a method of learning remote routes dynamically and keeping the routes available for a specified period of time, even though routing updates are not exchanged during that period. See the chapter “Configuring DDR” in the *Wide-Area Networking Configuration Guide* publication for detailed information about snapshot routing.

## Dial-on-Demand Routing Over ISDN

To place calls on the ISDN interface, you must configure it with dial-on-demand routing (DDR). See the chapter “Configuring DDR” in the *Wide-Area Networking Configuration Guide* publication for detailed information about DDR.

## Bandwidth on Demand and Dial Backup over ISDN

See the chapter “Configuring DDR” in the *Wide-Area Networking Configuration Guide* publication for detailed information about *bandwidth on demand* and *dial backup*.

## ISDN Configuration Options

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# Hardware Specifications and Cable Pinouts

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This appendix contains the following sections:

- Hardware Specifications—All models of Cisco 1600 series routers.
- Cable Pinouts—Cables that can be used with Cisco 1600 series routers.

## Hardware Specifications

Table C-1 lists the system specifications for Cisco 1600 series routers.

**Table C-1      System Specifications**

| Description                                         | Specification                   |
|-----------------------------------------------------|---------------------------------|
| Processor                                           | Motorola MC68360 QUICC (33 MHz) |
| <b>Dimensions</b>                                   |                                 |
| • Height                                            | 2.19 in. (5.56 cm)              |
| • Width                                             | 11.15 in. (28.32 cm)            |
| • Depth                                             | 8.67 in. (22.02 cm)             |
| <b>Weight</b>                                       |                                 |
| • Minimum (no WAN interface card installed)         | 1.65 LB (0.75 kg)               |
| • Maximum                                           | 1.80 LB (0.82 kg)               |
| Power (external)                                    | 14 VDC (+ / – 8%), minimum 1A   |
| Console port                                        | RJ-45 connector                 |
| 10BaseT port                                        | RJ-45 connector                 |
| AUI port                                            | DB-15 connector                 |
| Flash memory slot                                   | Flash PC card                   |
| Serial port (Cisco 1601)                            | DB-60 connector                 |
| DSU/CSU port (Cisco 1602)                           | RJ-48S connector                |
| ISDN ports <sup>1</sup> (Cisco 1603 and Cisco 1604) | RJ-45 connector                 |
| <b>Temperature</b>                                  |                                 |
| • Operating                                         | 32 to 104°F (0 to 40°C)         |
| • Nonoperating                                      | -4 to 149°F (-20 to 65°C)       |
| Operating humidity                                  | 5 to 95%, noncondensing         |

<sup>1</sup> ISDN ports refer to the ISDN S/T and the ISDN U ports.

# Cable Pinouts

This section includes the following pinouts:

- 10BaseT Port Pinouts
- Straight-Through 10BaseT Cable (RJ-45 to RJ-45) Pinouts
- Console Cable and Adapter Pinouts
- 56-kbps DSU/CSU (RJ-48S) Pinouts
- ISDN BRI S/T Port Pinouts (RJ-45)
- ISDN BRI U Port Pinouts (RJ-45)
- EIA/TIA-232 DTE Cable Pinouts (DB-60 to DB-25)
- EIA/TIA-449 DTE Cable Pinouts (DB-60 to DB-37)
- X.21 DTE Cable Pinouts (DB-60 to DB-15)
- V.35 Cable Pinouts (DB-60 to 34-Pin)
- EIA-530 DTE Cable Pinouts (DB-60 to DB-25)

**Table C-2      10BaseT Port Pinouts**

| 8 Pin <sup>1</sup> | Description |
|--------------------|-------------|
| 1                  | TX+         |
| 2                  | TX–         |
| 3                  | RX+         |
| 6                  | RX–         |

1 Pins 4, 5, 7, and 8 are not used.

## Cable Pinouts

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**Table C-3**      **Straight-Through 10BaseT Cable (RJ-45 to RJ-45) Pinouts**

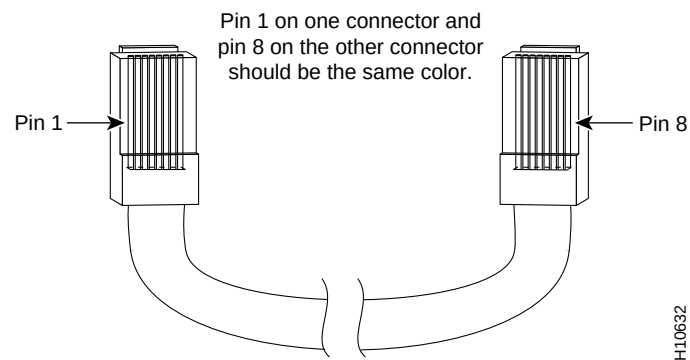
| <b>RJ-45<br/>Pin</b> | <b>Signal</b> | <b>Direction</b> | <b>RJ-45<br/>Pin</b> |
|----------------------|---------------|------------------|----------------------|
| 1                    | TX+           | —>               | 1                    |
| 2                    | TX-           | —>               | 2                    |
| 3                    | RX+           | <—               | 3                    |
| 4                    | —             | —                | 4                    |
| 5                    | —             | —                | 5                    |
| 6                    | RX-           | <—               | 6                    |
| 7                    | —             | —                | 7                    |
| 8                    | —             | —                | 8                    |

The EIA/TIA-232 console port is configured as data terminal equipment (DTE) and uses an RJ-45 connector. A console cable kit is provided with your router to connect a console (an ASCII terminal or PC running terminal emulation software) to the console port. The console cable kit contains an RJ-45-to-RJ-45 rollover cable and a RJ-45-to-DB-25 female DTE adapter (labeled Terminal). Table C-4 lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 rollover cable, and the RJ-45-to-DB-25 female DTE adapter.

**Table C-4 Console Cable and Adapter Pinouts**

|        | Console Port (DTE) | RJ-45-to-RJ-45 Roll-Over Cable |          |           |        |
|--------|--------------------|--------------------------------|----------|-----------|--------|
| Signal | RJ-45 Pin          | RJ-45 Pin                      | DB-9 Pin | DB-25 Pin | Signal |
| –      | 1                  | 8                              | 7        | 4         | –      |
| DTR    | 2                  | 7                              | 4        | 20        | DSR    |
| TxD    | 3                  | 6                              | 3        | 2         | RxD    |
| GND    | 4                  | 5                              | 5        | 7         | GND    |
| GND    | 5                  | 4                              | 5        | 7         | GND    |
| RxD    | 6                  | 3                              | 2        | 3         | TxD    |
| DSR    | 7                  | 2                              | 6        | 6         | DTR    |
| –      | 8                  | 1                              | 8        | 5         | –      |

You can identify a rollover cable by comparing the two modular ends of the cable. (See Figure C-1.) Holding the cables in your hand, side-by-side, with the tab at the back, the wire connected to the pin on the outside of the left connector (pin 1) should be the same color as the pin on the outside of the right connector (pin 8). On Cisco cables, pin 1 is white on one connector, and pin 8 is white on the other connector.

**Figure C-1 Identifying a Rollover Cable**

## Cable Pinouts

---

**Table C-5      56-kbps DSU/CSU (RJ-48S) Pinouts**

| 8 Pin <sup>1</sup> | Description |
|--------------------|-------------|
| 1                  | Transmit    |
| 2                  | Transmit    |
| 7                  | Receive     |
| 8                  | Receive     |

- 1 Pins 3, 4, 5, and 6 are not used.

**Table C-6      ISDN BRI S/T Port Pinouts (RJ-45)**

| 8 Pin <sup>1</sup> | TE <sup>2</sup> | NT <sup>3</sup> | Polarity |
|--------------------|-----------------|-----------------|----------|
| 3                  | Transmit        | Receive         | +        |
| 4                  | Receive         | Transmit        | +        |
| 5                  | Receive         | Transmit        | –        |
| 6                  | Transmit        | Receive         | –        |

- 1 Pins 1, 2, 7, and 8 are not used.
- 2 TE refers to terminal terminating layer 1 aspects of TE1, TA, and NT functional groups. This applies to the Cisco 1603 and the ISDN BRI S/T WAN interface card.
- 3 NT refers to network terminating layer 1 aspects of NT1 and NT2 functional groups. This applies to the Cisco 1604 ISDN S/T port.

**Table C-7      ISDN BRI U Port Pinouts (RJ-45)**

| 8 Pin <sup>1</sup> | Function           |
|--------------------|--------------------|
| 3                  | No connection      |
| 4                  | Signal—Tip or Ring |
| 5                  | Signal—Tip or Ring |
| 6                  | No connection      |

- 1 Pins 1, 2, 7, and 8 are not used.

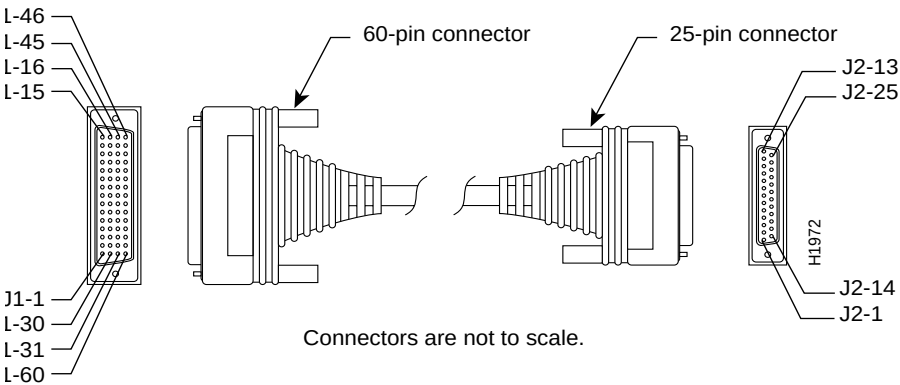
The serial port on the router uses a universal port, a 60-pin receptacle that supports the following serial interfaces: EIA/TIA-232, EIA/TIA-449, X.21, V.35, and EIA-530. The shielded serial transition cable determines the electrical interface type. The router end of all of the cables is a 60-pin connector.

DTE connectors have a plug connector at the network end. (DCE connectors have a receptacle at the network end.) However, V.35 is available in DTE mode either a receptacle or a plug connector at the network end. The serial port operates in DTE and DCE modes.

The tables that follow list the signal pinouts for the DTE mode serial transition cables for each router interface type.

Figure C-2 shows the EIA/TIA-232 serial cable assembly, and Table C-8 lists the EIA/TIA-232 cable pinouts.

**Figure C-2      EIA/TIA-232 Serial Cable Assembly**



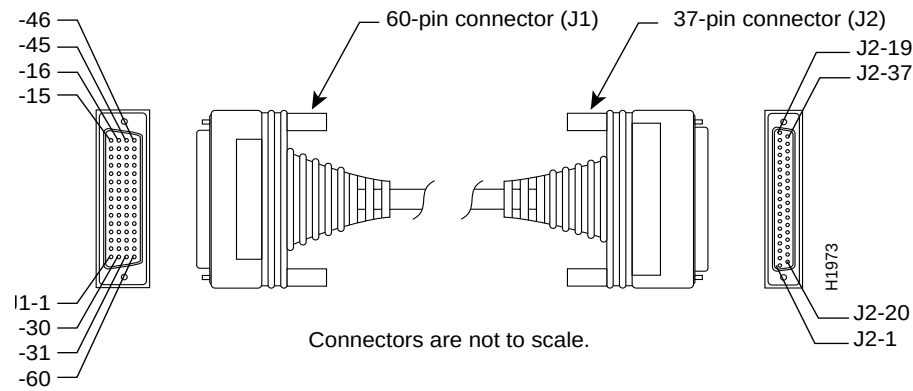
## Cable Pinouts

**Table C-8 EIA/TIA-232 DTE Cable Pinouts (DB-60 to DB-25)**

| 60 Pin <sup>1</sup> | Signal      | Description         | Direction | 25 Pin | Signal      |
|---------------------|-------------|---------------------|-----------|--------|-------------|
| J1-50               | MODE_0      | Shorting group      | –         | –      | –           |
| J1-51               | GND         |                     |           |        |             |
| J1-52               | MODE_DCE    |                     |           |        |             |
| J1-46               | Shield GND  | Single              | –         | J2-1   | Shield GND  |
| J1-41               | TxD/RxD     | Twisted pair no. 5  | —>        | J2-2   | TxD         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-36               | RxD/TxD     | Twisted pair no. 9  | <—        | J2-3   | RxD         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-42               | RTS/CTS     | Twisted pair no. 4  | —>        | J2-4   | RTS         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-35               | CTS/RTS     | Twisted pair no. 10 | <—        | J2-5   | CTS         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-34               | DSR/DTR     | Twisted pair no. 11 | <—        | J2-6   | DSR         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-45               | Circuit GND | Twisted pair no. 1  | –         | J2-7   | Circuit GND |
| Shield              | –           |                     | –         | Shield | –           |
| J1-33               | DCD/LL      | Twisted pair no. 12 | <—        | J2-8   | DCD         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-37               | TxC/NIL     | Twisted pair no. 8  | <—        | J2-15  | TxC         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-38               | RxC/TxCE    | Twisted pair no. 7  | <—        | J2-17  | RxC         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-44               | LL/DCD      | Twisted pair no. 2  | —>        | J2-18  | LTST        |
| Shield              | –           |                     | –         | Shield | –           |
| J1-43               | DTR/DSR     | Twisted pair no. 3  | —>        | J2-20  | DTR         |
| Shield              | –           |                     | –         | Shield | –           |
| J1-39               | TxCE/TxC    | Twisted pair no. 6  | —>        | J2-24  | TxCE        |
| Shield              | –           |                     | –         | Shield | –           |

<sup>1</sup> Any pin not referenced is not connected.

Figure C-3 EIA/TIA-449 Serial Cable Assembly



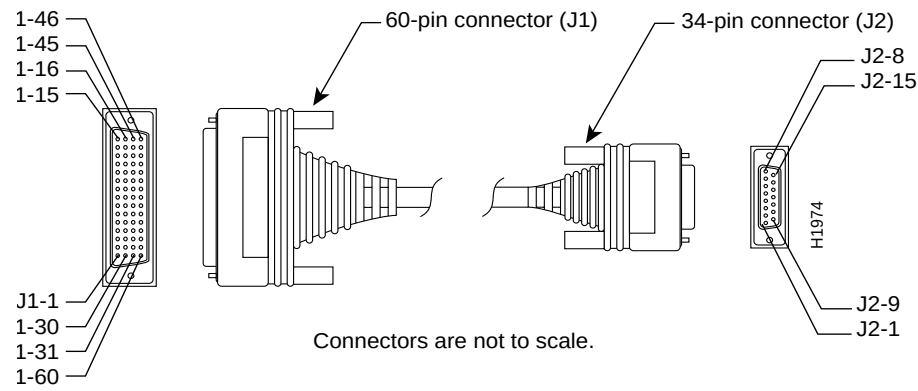
## Cable Pinouts

**Table C-9 EIA/TIA-449 DTE Cable Pinouts (DB-60 to DB-37)**

| 60 Pin <sup>1</sup> | Signal                     | Description         | Direction | 37 Pin         | Signal     |
|---------------------|----------------------------|---------------------|-----------|----------------|------------|
| J1-49<br>J1-48      | MODE_1<br>GND              | Shorting group      | —         | —              | —          |
| J1-51<br>J1-52      | GND<br>MODE_DCE            | Shorting group      | —         | —              | —          |
| J1-46               | Shield_GND                 | Single              | —         | J2-1           | Shield GND |
| J1-11<br>J1-12      | TxD/RxD+<br>TxD/RxD—       | Twisted pair no. 6  | —><br>—>  | J2-4<br>J2-22  | SD+<br>SD— |
| J1-24<br>J1-23      | TxC/RxC+<br>TxC/RxC—       | Twisted pair no. 9  | <—<br><—  | J2-5<br>J2-23  | ST+<br>ST— |
| J1-28<br>J1-27      | RxD/TxD+<br>RxD/TxD—       | Twisted pair no. 11 | <—<br><—  | J2-6<br>J2-24  | RD+<br>RD— |
| J1-9<br>J1-10       | RTS/CTS+<br>RTS/CTS—       | Twisted pair no. 5  | —><br>—>  | J2-7<br>J2-25  | RS+<br>RS— |
| J1-26<br>J1-25      | RxC/TxCE+<br>RxC/TxCE—     | Twisted pair no. 10 | <—<br><—  | J2-8<br>J2-26  | RT+<br>RT— |
| J1-1<br>J1-2        | CTS/RTS+<br>CTS/RTS—       | Twisted pair no. 1  | <—<br><—  | J2-9<br>J2-27  | CS+<br>CS— |
| J1-44<br>J1-45      | LL/DCD<br>Circuit_GND      | Twisted pair no. 12 | —><br>—   | J2-10<br>J2-37 | LL<br>SC   |
| J1-3<br>J1-4        | DSR/DTR+<br>DSR/DTR—       | Twisted pair no. 2  | <—<br><—  | J2-11<br>J2-29 | DM+<br>DM— |
| J1-7<br>J1-8        | DTR/DSR+<br>DTR/DSR—       | Twisted pair no. 4  | —><br>—>  | J2-12<br>J2-30 | TR+<br>TR— |
| J1-5<br>J1-6        | DCD/DCD+<br>DCD/DCD—       | Twisted pair no. 3  | <—<br><—  | J2-13<br>J2-31 | RR+<br>RR— |
| J1-13<br>J1-14      | TxCE/TxC+<br>TxCE/TxC—     | Twisted pair no. 7  | —><br>—>  | J2-17<br>J2-35 | TT+<br>TT— |
| J1-15<br>J1-16      | Circuit_GND<br>Circuit_GND | Twisted pair no. 9  | —<br>—    | J2-19<br>J2-20 | SG<br>RC   |

<sup>1</sup> Any pin not referenced is not connected.

Figure C-4 X.21 Cable Assembly



## Cable Pinouts

**Table C-10 X.21 DTE Cable Pinouts (DB-60 to DB-15)**

| 60 Pin <sup>1</sup> | Signal                 | Description        | Direction | 15 Pin         | Signal                     |
|---------------------|------------------------|--------------------|-----------|----------------|----------------------------|
| J1-48<br>J1-47      | GND<br>MODE_2          | Shorting group     | —         | —              | —                          |
| J1-51<br>J1-52      | GND<br>MODE_DCE        | Shorting group     | —         | —              | —                          |
| J1-46               | Shield_GND             | Single             | —         | J2-1           | Shield GND                 |
| J1-11<br>J1-12      | TxD/RxD+<br>TxD/RxD—   | Twisted pair no. 3 | —><br>—>  | J2-2<br>J2-9   | Transmit+<br>Transmit—     |
| J1-9<br>J1-10       | RTS/CTS+<br>RTS/CTS—   | Twisted pair no. 2 | —><br>—>  | J2-3<br>J2-10  | Control+<br>Control—       |
| J1-28<br>J1-27      | RxD/TxD+<br>RxD/TxD—   | Twisted pair no. 6 | <—<br><—  | J2-4<br>J2-11  | Receive+<br>Receive—       |
| J1-1<br>J1-2        | CTS/RTS+<br>CTS/RTS—   | Twisted pair no. 1 | <—<br><—  | J2-5<br>J2-12  | Indication+<br>Indication— |
| J1-26<br>J1-25      | RxC/TxCE+<br>RxC/TxCE— | Twisted pair no. 5 | <—<br><—  | J2-6<br>J2-13  | Timing+<br>Timing—         |
| J1-15<br>Shield     | Control_GND<br>—       | Twisted pair no. 4 | —<br>—    | J2-8<br>Shield | Control GND<br>—           |

1 Any pin not referenced is not connected.

Figure C-5 V.35 Cable Assembly

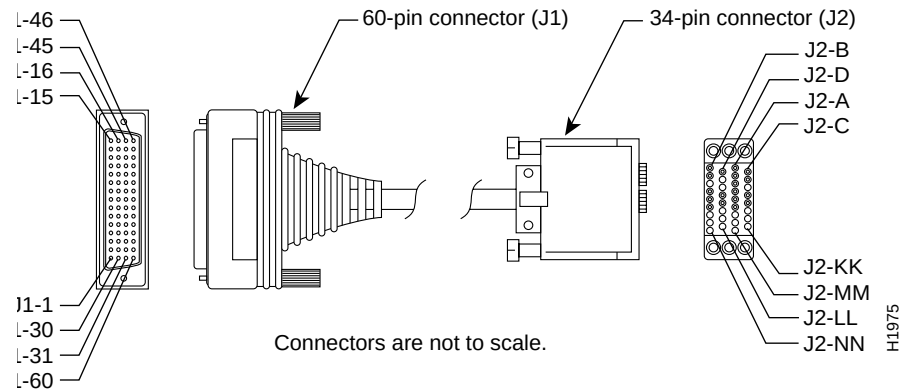


Table C-11 V.35 Cable Pinouts (DB-60 to 34-Pin)

| 60 Pin <sup>1</sup> | Signal      | Description         | Direction | 34 Pin | Signal      |
|---------------------|-------------|---------------------|-----------|--------|-------------|
| J1-49               | MODE_1      | Shorting group      | —         | —      | —           |
| J1-48               | GND         |                     |           |        |             |
| J1-50               | MODE_0      | Shorting group      | —         | —      | —           |
| J1-51               | GND         |                     |           |        |             |
| J1-52               | MODE_DCE    |                     |           |        |             |
| J1-53               | TxC/NIL     | Shorting group      | —         | —      | —           |
| J1-54               | RxC_TxCE    |                     |           |        |             |
| J1-55               | RxD/TxD     |                     |           |        |             |
| J1-56               | GND         |                     |           |        |             |
| J1-46               | Shield_GND  | Single              | —         | J2-A   | Frame GND   |
| J1-45               | Circuit_GND | Twisted pair no. 12 | —         | J2-B   | Circuit GND |
| Shield              | —           |                     | —         | Shield | —           |
| J1-42               | RTS/CTS     | Twisted pair no. 9  | —>        | J2-C   | RTS         |
| Shield              | —           |                     | —         | Shield | —           |
| J1-35               | CTS/RTS     | Twisted pair no. 8  | <—        | J2-D   | CTS         |
| Shield              | —           |                     | —         | Shield | —           |

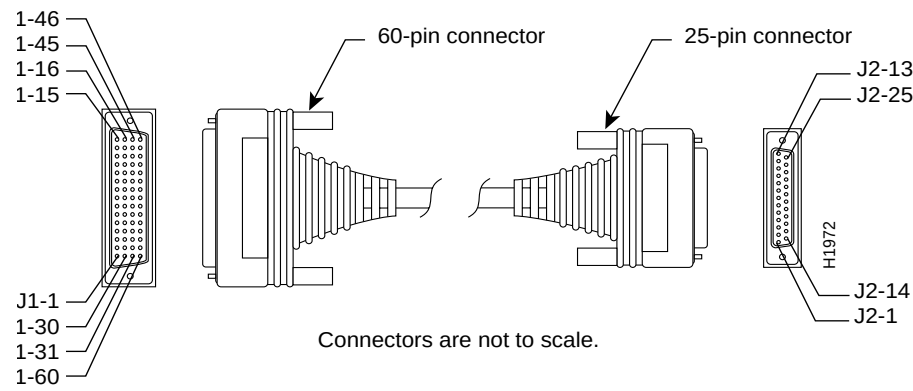
## Cable Pinouts

**Table C-11 V.35 Cable Pinouts (DB-60 to 34-Pin) (Continued)**

| 60 Pin <sup>1</sup> | Signal                 | Description         | Direction | 34 Pin         | Signal         |
|---------------------|------------------------|---------------------|-----------|----------------|----------------|
| J1-34<br>Shield     | DSR/DTR<br>–           | Twisted pair no. 7  | <—<br>–   | J2-E<br>Shield | DSR<br>–       |
| J1-33<br>Shield     | DCD/LL<br>–            | Twisted pair no. 6  | <—<br>–   | J2-F<br>Shield | RLSD<br>–      |
| J1-43<br>Shield     | DTR/DSR<br>–           | Twisted pair no. 10 | —><br>–   | J2-H<br>Shield | DTR<br>–       |
| J1-44<br>Shield     | LL/DCD<br>–            | Twisted pair no. 11 | —><br>–   | J2-K<br>Shield | LT<br>–        |
| J1-18<br>J1-17      | TxD/RxD+<br>TxD/RxD–   | Twisted pair no. 1  | —><br>—>  | J2-P<br>J2-S   | SD+<br>SD–     |
| J1-28<br>J1-27      | RxD/TxD+<br>RxD/TxD–   | Twisted pair no. 5  | <—<br><—  | J2-R<br>J2-T   | RD+<br>RD–     |
| J1-20<br>J1-19      | TxCE/TxC+<br>TxCE/TxC– | Twisted pair no. 2  | —><br>—>  | J2-U<br>J2-W   | SCTE+<br>SCTE– |
| J1-26<br>J1-25      | RxC/TxCE+<br>RxC/TxCE– | Twisted pair no. 4  | <—<br><—  | J2-V<br>J2-X   | SCR+<br>SCR–   |
| J1-24<br>J1-23      | TxC/RxC+<br>TxC/RxC–   | Twisted pair no. 3  | <—<br><—  | J2-Y<br>J2-AA  | SCT+<br>SCT–   |

1 Any pin not referenced is not connected.

Figure C-6 EIA-530 Cable Assembly



## Cable Pinouts

**Table C-12 EIA-530 DTE Cable Pinouts (DB-60 to DB-25)**

| 60 Pin <sup>1</sup> | Signal      | 25 Pin | Signal       | Direction |                  |
|---------------------|-------------|--------|--------------|-----------|------------------|
|                     |             |        |              | DTE       | DCE <sup>2</sup> |
| J1-11               | TxD/RxD+    | J2-2   | BA(A), TxD+  | —>        |                  |
| J1-12               | TxD/RxD–    | J2-14  | BA(B), TxD–  | —>        |                  |
| J1-28               | RxD/TxD+    | J2-3   | BB(A), RxD+  | <—        |                  |
| J1-27               | RxD/TxD–    | J2-16  | BB(B), RxD–  | <—        |                  |
| J1-9                | RTS/CTS+    | J2-4   | CA(A), RTS+  | —>        |                  |
| J1-10               | RTS/CTS–    | J2-19  | CA(B), RTS–  | —>        |                  |
| J1-1                | CTS/RTS+    | J2-5   | CB(A), CTS+  | <—        |                  |
| J1-2                | CTS/RTS–    | J2-13  | CB(B), CTS–  | <—        |                  |
| J1-3                | DSR/DTR+    | J2-6   | CC(A), DSR+  | <—        |                  |
| J1-4                | DSR/DTR–    | J2-22  | CC(B), DSR–  | <—        |                  |
| J1-46               | Shield_GND  | J2-1   | Shield       | Shorted   |                  |
| J1-47               | MODE_2      | –      | –            |           |                  |
| J1-48               | GND         | –      | –            | Shorted   |                  |
| J1-49               | MODE_1      | –      | –            |           |                  |
| J1-5                | DCD/DCD+    | J2-8   | CF(A), DCD+  | <—        |                  |
| J1-6                | DCD/DCD–    | J2-10  | CF(B), DCD–  | <—        |                  |
| J1-24               | TxC/RxC+    | J2-15  | DB(A), TxC+  | <—        |                  |
| J1-23               | TxC/RxC–    | J2-12  | DB(B), TxC–  | <—        |                  |
| J1-26               | RxC/TxCE+   | J2-17  | DD(A), RxC+  | <—        |                  |
| J1-25               | RxC/TxCE–   | J2-9   | DD(B), RxC–  | <—        |                  |
| J1-44               | LL/DCD      | J2-18  | LL           | —>        |                  |
| J1-45               | Circuit_GND | J2-7   | Circuit_GND  | –         |                  |
| J1-7                | DTR/DSR+    | J2-20  | CD(A), DTR+  | —>        |                  |
| J1-8                | DTR/DSR–    | J2-23  | CD(B), DTR–  | —>        |                  |
| J1-13               | TxCE/TxC+   | J2-24  | DA(A), TxCE+ | —>        |                  |
| J1-14               | TxCE/TxC–   | J2-11  | DA(B), TxCE– | —>        |                  |

<sup>1</sup> Any pin not referenced is not connected.

<sup>2</sup> The EIA-530 interface cannot be operated in DCE mode. A DCE cable is not available for the EIA-530 interface.